HydroTherm®

ENERGY STAR

# KN Series

**Cast iron condensing boilers**

**Models KN-2 and KN-4**

# Control manual

**Control adjustment and operation instructions**

**Also read and follow:**

**KN Boiler manual**

**KN Vent/air manual**

DESIGN CERTIFIED

I=B=R®

CERTIFIED

**WARNING** This manual is intended only for use by a qualified heating installer/technician. Read and follow this manual, all supplements and related instructional information provided with the boiler. Install, start and service the boiler only in the sequence and methods given in these instructions. Failure to do so can result in severe personal injury, death or substantial property damage.

**WARNING** **Do not use the boiler during construction.** Construction dust and particulate, particularly drywall dust, will cause contamination of the burner, resulting in possible severe personal injury, death or substantial property damage. The boiler can only be operated with a dust-free air supply. Follow the instruction manual procedures to duct air to the boiler air intake. If the boiler has been contaminated by operation with contaminated air, follow the instruction manual guidelines to clean, repair or replace the boiler if necessary.

**CAUTION** Affix these instructions near to the boiler/water heater. Instruct the building owner to retain the instructions for future use by a qualified service technician, and to follow all guidelines in the User's Information Manual.

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# The KN boiler — HeatNet™ control

## Control overview

The KN HeatNet control monitors boiler temperature and limit circuit inputs, modulating boiler firing rate to meet demand. The control uses microprocessor electronics, watching time-average response from the system to anticipate how much heat the system needs. Coupled with the five-to-one turndown of the KN boiler, this results in maximum possible condensing-mode operation. The KN boiler will provide unmatched seasonal efficiency.

## Indoor air reset (IAR)

HydroTherm's unique approach to boiler output regulation is its Indoor Air Reset function. The control monitors the demand from up to 8 different zones. Watching the demand duration and response to supply temperature, averaging over time, the HeatNet control anticipates system needs. It sets boiler maximum firing rate and adjusts supply water temperature to fine-tune boiler heat output. All that is required to enable IAR is to connect thermostat circuit wires to the IAR inputs. The HeatNet control can also be configured for outdoor reset operation, but IAR provides response based on system behavior rather than just looking at outdoor temperature.

## The HeatNet platform

HeatNet controls are designed to provide an integrated boiler management system on every boiler. The platform provides multiple levels of selectivity. HeatNet electronics can be operated as a simple single-boiler control, while still providing intelligent regulation of boiler firing rate to match system demand. With a few key strokes on the key pad, the HeatNet control can operate as a sophisticated multiple-boiler controller, using simple RJ45 cable interfacing between units. The control can even accept external control commands from building managements systems (Modbus standard, with optional bridge for BACnet or LonWorks) or 20-milliamp analog input from an external controller.

The control method used by the HeatNet control is based on digital communications, which eliminates the need for analog control signals. Analog signal inputs are supported, but a higher level of control precision, repeatability and feedback is gained with digital communications.

The HeatNet control can be versatile, providing for operation in multiple ways:

- Operation as a stand-alone boiler.
- Operation as a boiler in a boiler network, using the on-board HeatNet protocol.
- Operation as a member boiler in a boiler management system.
- Operation as a member of a remotely-controlled boiler network (20-milliamp regulation).
- Setpoint can be determined by the HeatNet control or by a 20-milliamp input signal.

## PID response

The HeatNet control uses proportional-integral-derivative calculations to determine the response to boiler water temperature changes. This means it not only looks at how far away the water temperature is from the setpoint temperature, but how fast the temperature is changing and how it has responded over time. This ensures the boiler won't make sudden unnecessary changes in firing rate.

## Multiple boiler operation

The HeatNet control easily interfaces with other HeatNet controls. Multiple boiler operation using HeatNet protocol only requires RJ45 cables daisy-chained from boiler to boiler and a few key strokes setting up control behavior. The master boiler is automatically selected by connecting a sensor lead to its HEADER sensor terminals. The HeatNet control recognizes the sensor and configures the boiler as the master. Other boilers only need to have an address assigned.

Among the advanced design features of the HeatNet control is the MOD-MAX setting. This limits the firing rate of all boilers to a pre-set maximum (50% by default). This means all of the boilers will be run at a very efficient level until all boilers are on. Only then can firing rate increase above this setting. Boiler rotation can be first-on/first-off, first-on/last-off, or true rotation (the HeatNet control monitors the total on time of all boilers, and rotates their usage so the total on time is the same for all).



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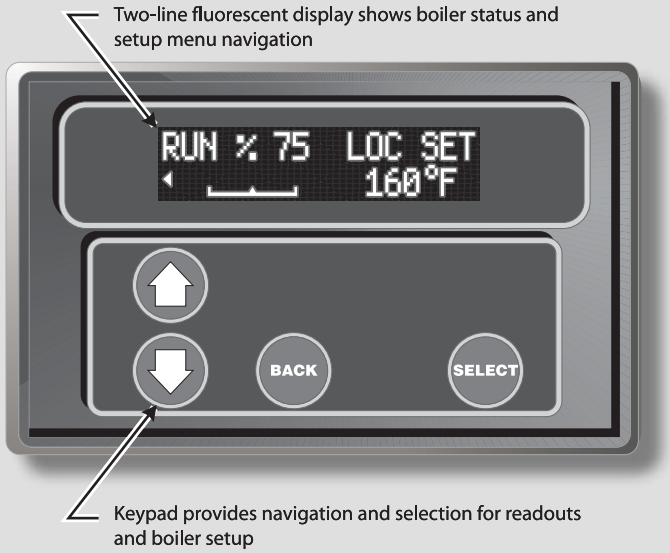
# The KN boiler — HeatNet™ control

## KN Control panel

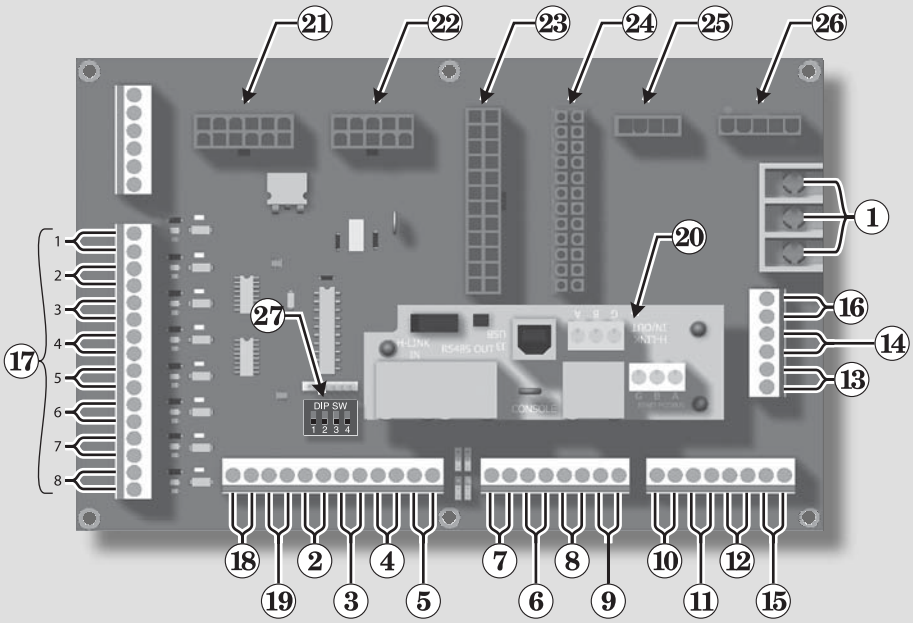
(Located on boiler front — shown with keypad cover removed)


Two-line fluorescent display shows boiler status and setup menu navigation
RUN % 75 LOC SET
160°F
BACK
SELECT
Keypad provides navigation and selection for readouts and boiler setup

## Electrical connection board

(Located in center panel on boiler right side)

(All field and boiler wiring connects here)




(All boiler wiring is made with non-interchangeable plug-in harnesses, connected to this board)

## Wiring connections

1. Power wiring, 120 vac
2. Heat demand input
3. DHW demand input
4. Low fire terminals
5. High fire terminals
6. To boiler outlet water temperature sensor
7. To optional outdoor temperature sensor
8. To optional boiler return water temperature sensor
9. To optional header temperature sensor
10. To boiler postpurge pump (factory piped and wired)
11. To boiler circulator
12. Alarm output dry contacts
13. To external high limit and/or low water cutoff if desired
14. To flow switch, when used
15. Used to activate combustion air damper if desired
16. To combustion air damper proving switch, required when controlling combustion air damper
17. Indoor air reset inputs — connect to up to 8 zone thermostats
18. Optional 20 ma control signal input
19. Remote enable to start when operating on 20 ma input
20. Optional HeatNet communications board
21. Boiler wiring socket to blower and gas valve
22. Boiler wiring socket to pressure switches and Fenwal control
23. Boiler wiring socket to control panel
24. Boiler wiring socket to control panel
25. Boiler wiring socket to power switch
26. Boiler wiring socket to transformer
27. Termination DIP switches

KN components

# The KN boiler — with HeatNet™ control

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# Contents

## 1 Method 1: HeatNet modulation – control. . . . . page 6

- The KN HeatNet control can control up to (16) KN boilers using built-in software and hardware.
- Install a RS485 interface on each boiler and connect with RJ45 HeatNet cables (or shielded wires).
- The header water temperature setpoint can be set by the master boiler or by a 4-20ma input from an external controller.
- Member boilers can override master boiler control if they receive a contact closure on the Heat Demand or DHW Demand terminals.

## 2 Method 2: HeatNet modulation – BMS . . . . . page 14

- This method uses the KN control's built-in communications capabilities to accept Modbus protocol inputs from a building management system. The master boiler control sequences and modulates the boiler network to accomplish the demands from the building management system.
- Each boiler requires the RS485 interface board and cable, above.
- Boiler setup is essentially the same as for method 1, with the exception that each boiler must be assigned both a HeatNet network address and an address for the Modbus interface.
- An additional bus is required to interface with systems using BACnet or LonWorks protocol.
- The master boiler will take control and regulate the boiler network if signal from the BMS is lost or times out.

## 3 Method 3: External 4-20ma control . . . . . page 16

- Up to 5 boilers can be controlled by an external control that provides a 4-20ma input signal. The external controls must also activate each boiler by closing a contact across the boiler's 4-20ma Remote Enable contacts.
- Member boilers can override external boiler control if they receive a contact closure on the Heat Demand or DHW Demand terminals.

## 4 Control menus and adjustments . . . . . page 22

- Operating parameters and control behaviors are set using the KN control's display/keypad interface.
- Refer to this section for the menu structure and explanations of the setting options.

## 5 Troubleshooting . . . . . page 31

# 1 Method 1: HeatNet modulation – local control

**WARNING** **Electrical shock hazard —** Disconnect all electrical power sources to the boiler before making any electrical connections.

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation! Verify proper operation after servicing.

Failure to comply with the above could result in severe personal injury, death or substantial property damage.

**NOTICE** The electrical connections to this boiler must be made in accordance with all applicable local codes and the latest revision of the National Electrical Code, ANSI /NFPA-70. Installation should also conform to CSA C22.1 Canadian Electrical Code Part I if installed in Canada. Install a separate 120 volt 15 amp circuit for the boiler. A properly rated shut-off switch should be located at the boiler. The boiler must be grounded in accordance with the authority having jurisdiction, or if none, the latest revision of the National Electrical Code, ANSI/NFPA-70.

Line voltage field wiring of any controls or other devices must use copper conductors with a minimum size of #14 awg. Use appropriate wiring materials for units installed outdoors.

**Figure 1** Electrical connection board (see item 10, page 3 for location — Also see the wiring summary illustrations on the next pages)

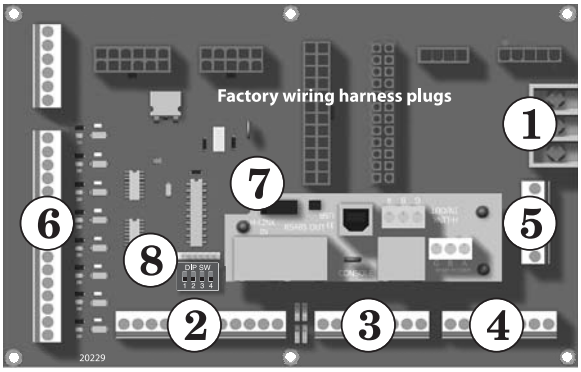
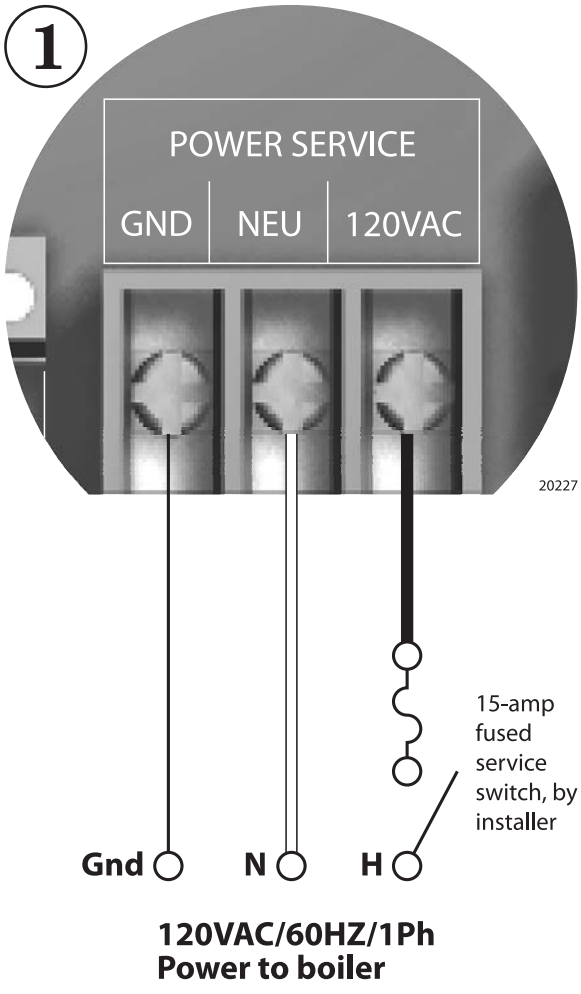



**Figure 2** 120VAC power service terminals on electrical connection board — See Figure 15 for location of the power terminal strip




## Overview — control setup sequence

**CAUTION** **Follow the Boiler manual** — Install the boilers according to the KN Boiler manual before attempting to set up the control system.

1. Install all boilers per the Boiler manual.
2. Close the external gas valve on every boiler.
3. Wire all boilers following the guidelines in this section.
4. Attach a header sensor to the master boiler ONLY. The KN-2 control automatically configures the boiler with a header sensor as the master.
5. Set the master boiler control parameters using its display/keypad.
6. Set the master boiler's termination DIP switches.
7. Set the termination DIP switches on the member boilers.
8. Set the member boilers' control parameters using their display/keypads.
9. Follow the instructions in the Boiler manual to start up each boiler before proceeding further.
10. Finish by connecting cables between the communications boards of all of the boilers and verifying network operation.

## Add communications modules

1. Insert a RS485 communications module onto each of the boilers' electrical connection panels, as shown in Figure 1.

## Power supply (120 VAC)

1. See Figure 1 and Figure 2.
2. Connect minimum 14awg copper wire to the power connection as shown in Figure 2.
3. Install a fused service switch, mounted and installed in accordance with all applicable codes.



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# Method 1: HeatNet modulation – local control *(cont.)*

## Circulator wiring

### Postpurge circulator (KN-2 only)

- **The circulator shipped installed with the boiler cannot be used for system circulation.** It must be used as supplied from the factory. It circulates water after the boiler stops firing to prevent potential damage from heat pocketing in the top of the heat exchanger.
- The postpurge circulator is factory-piped and pre-wired. Do not change the usage, the wiring, the location or the piping.

### Boiler circulator

- See the Boiler manual for circulator piping.
- Figure 3, Figure 4, and Figure 5 show wiring of the Boiler circulator (or boiler/system circulator) to the terminal strip of the KN-2 electrical connection board.
- DO NOT directly connect a circulator with a motor larger than 1/4 hp. For larger motors, install a circulator relay or motor contactor . Figure 3 and Figure 4 show the correct ways to install the boiler circulator using a relay or motor starter.

**Figure 3** Wiring the boiler circulator using a circulator relay (required for motors over 1/4 hp)

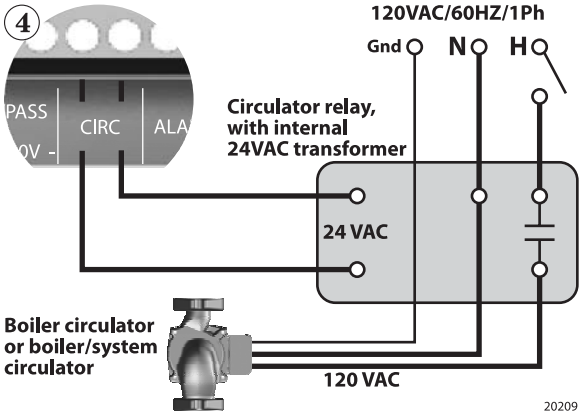



**Figure 4** Wiring the boiler circulator using a relay or starter (required for motors over 1/4 hp)

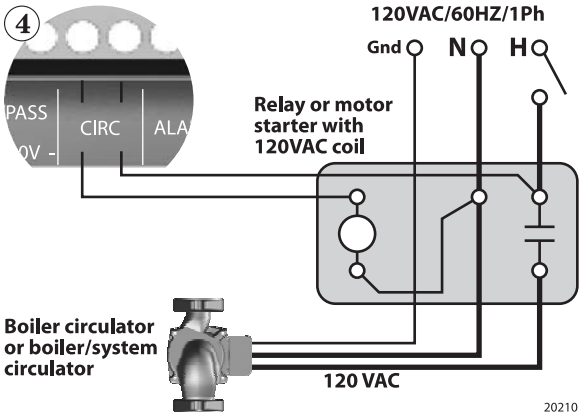
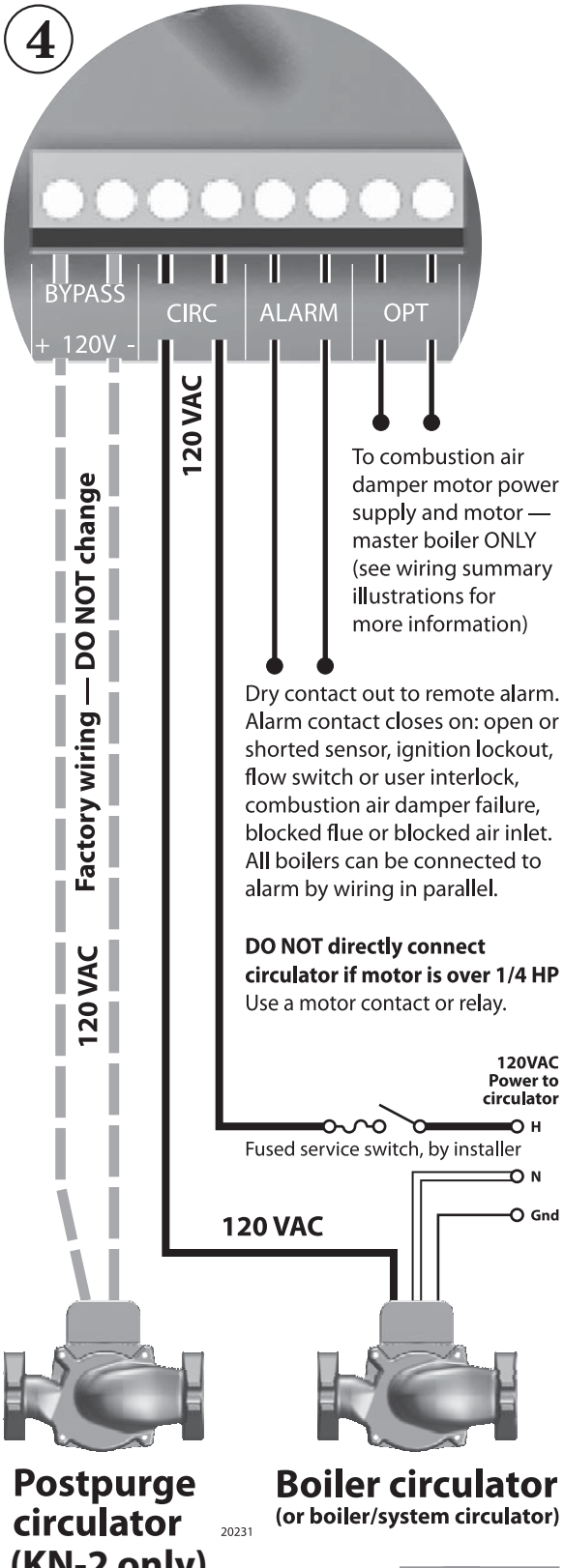



**Figure 5** Circulator wiring terminal strip (see Figure 1, page 6, for location) — Also see the wiring summary illustrations on the next pages)


4
BYPASS
CIRC
ALARM
OPT
+ 120V -
120 VAC
Factory wiring — DO NOT change
120 VAC
To combustion air damper motor power supply and motor — master boiler ONLY (see wiring summary illustrations for more information)
Dry contact out to remote alarm. Alarm contact closes on: open or shorted sensor, ignition lockout, flow switch or user interlock, combustion air damper failure, blocked flue or blocked air inlet. All boilers can be connected to alarm by wiring in parallel.
DO NOT directly connect circulator if motor is over 1/4 HP
Use a motor contact or relay.
120VAC Power to circulator
H
Fused service switch, by installer
N
Gnd
120 VAC
Postpurge circulator (KN-2 only)
Boiler circulator (or boiler/system circulator)
20231

# 1 Method 1: HeatNet modulation – local control *(cont.)*

## IAR (Indoor Air Reset) wiring, when used

- Heat Demand terminal connections — The end switch leads from the zone valves must connect to the Heat Demand terminals on the electrical connection board as shown in Figure 7, page 9.
- See Figure 6 for typical wiring to the IAR inputs when using 4-wire zone valves without a zone controller. For other applications, such as circulator relays or zone controllers, see Appendix A in the Boiler manual..

**CAUTION** **Polarity** — The connections to the **IAR** positive terminals (**IAR +**) must be to the same location on the zone valve as the thermostat wire, as shown in Figure A1. The connections to the **IAR** negative terminals (**IAR –**) must be from the zone valve terminal connected to the 24VAC common line, as shown. Connecting the wires incorrectly can cause the transformer to be shorted out and damaged. Verify the wiring with a voltmeter.

**CAUTION** Always use a voltmeter to check the leads coming from the end switches of the zone valves. With the thermostat calling for heat, connect the voltmeter leads across the wires coming from the end switches. If the meter shows a voltage reading, the zone valve wires are incorrect. Change the wiring and retest. DO NOT connect the wires to the boiler until you have tested as described. Incorrect wiring can damage the boiler control or other system components.

- If there is only one transformer feeding all of the zone valves in the system, you can omit the wires to the **IAR** negative terminals (**IAR –**) on all but one of the zone valves. This is because these terminals are jumpered internally on the electrical connection board. If there is more than one transformer, provide one wire from each transformer common side to one of the **IAR** negative terminals (**IAR –**).

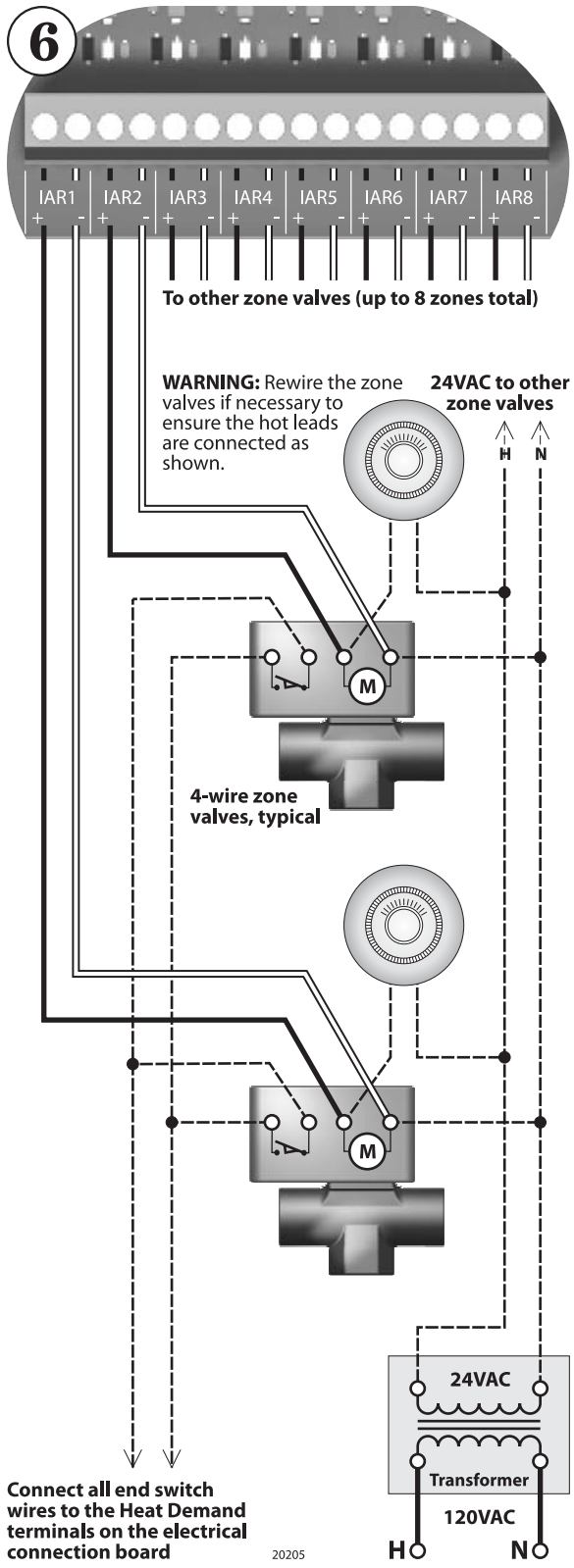
## Sensor wiring

- **Header sensor is required** — A header sensor must be installed in the system supply piping. **Connect the header sensor ONLY to the master boiler**. Install the header sensor in an immersion well. Locate the sensor where it will accurately sense the system water supply temperature. Connect the sensor leads to the electrical connection board as shown in Figure 8, page 10.
- **Outdoor reset application** — To operate with outdoor reset, purchase and install an outdoor sensor. Mount the sensor such that it is shielded from direct sunlight if possible and not likely to be covered by snow drifts or debris. Connect the outdoor sensor leads to the master boiler's electrical connection board as shown in Figure 8, page 10. (Member boilers could have their own outdoor sensor if they will be operated in override mode by closing the Heat Demand terminals.)
- **Return water temperature sensor** — The return water temperature sensor is optional, only needed if you want to automatically control the boiler postpurge pump cycle time. Install the sensor in a well in the boiler return piping. Connect the sensor leads to the electrical connection board as shown in Figure 8, page 10.

## DHW wiring

- To operate the boiler for domestic water heating with a storage tank, install and pipe the tank according to the tank manufacturer's instructions and the recommended piping diagrams in this manual. Consult the factory for applications not covered.
- The circulator used for DHW must be operated by a circulator relay or zone controller that is activated when the tank aquastat calls for heat.
- Connect the tank aquastat terminals across the DHW DEMAND terminals on the master boiler's electrical connection board as shown in Figure 7, page 9. (Member boilers could be connected to tank aquastats if they are piped appropriately and intended to operate in override mode.)

**Figure 6** Indoor Air Reset wiring to IAR terminals with 4-wire zone valves and no zone controller
(see Figure 7, page 9 for terminal block **6** location)



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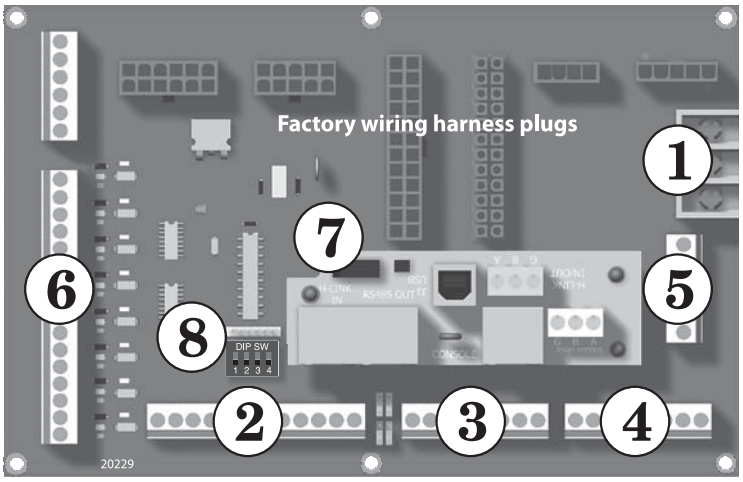
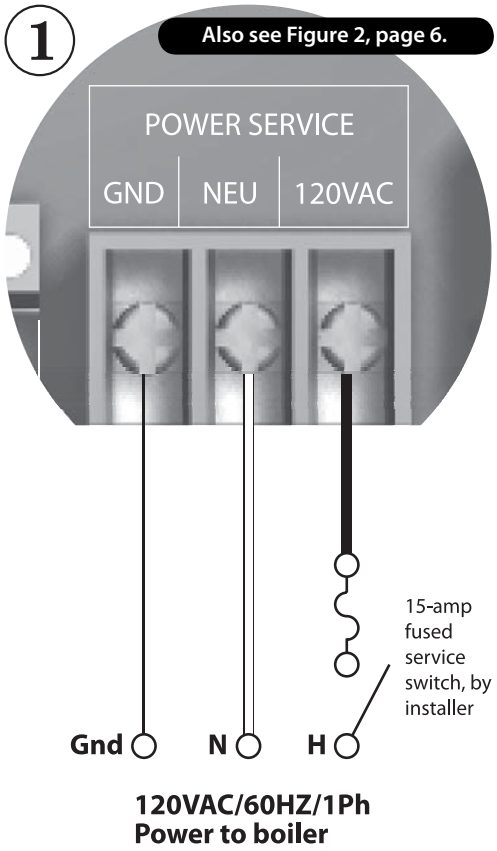
# 1 Method 1: HeatNet modulation – local control *(cont.)*

**Figure 7** KN wiring summary — wiring to electrical connection board

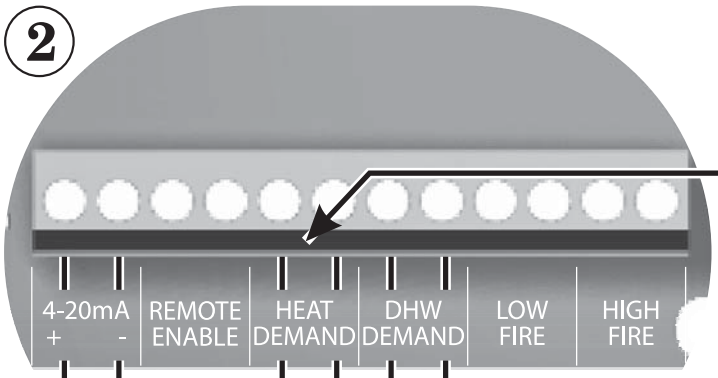



**Electrical connection board**

(Located in center panel on boiler right side)




**120VAC/60HZ/1Ph Power to boiler**




The boiler is shipped with a jumper across the HEAT DEMAND terminals. Remove this jumper when using a thermostat or other external control to start the boiler.

Use these terminals only during boiler setup as given in the Boiler manual

**DHW tank aquastat, when used**
(A DHW circulator and circulator relay will be required. Start the DHW circulator on call for heat from the tank aquastat.)

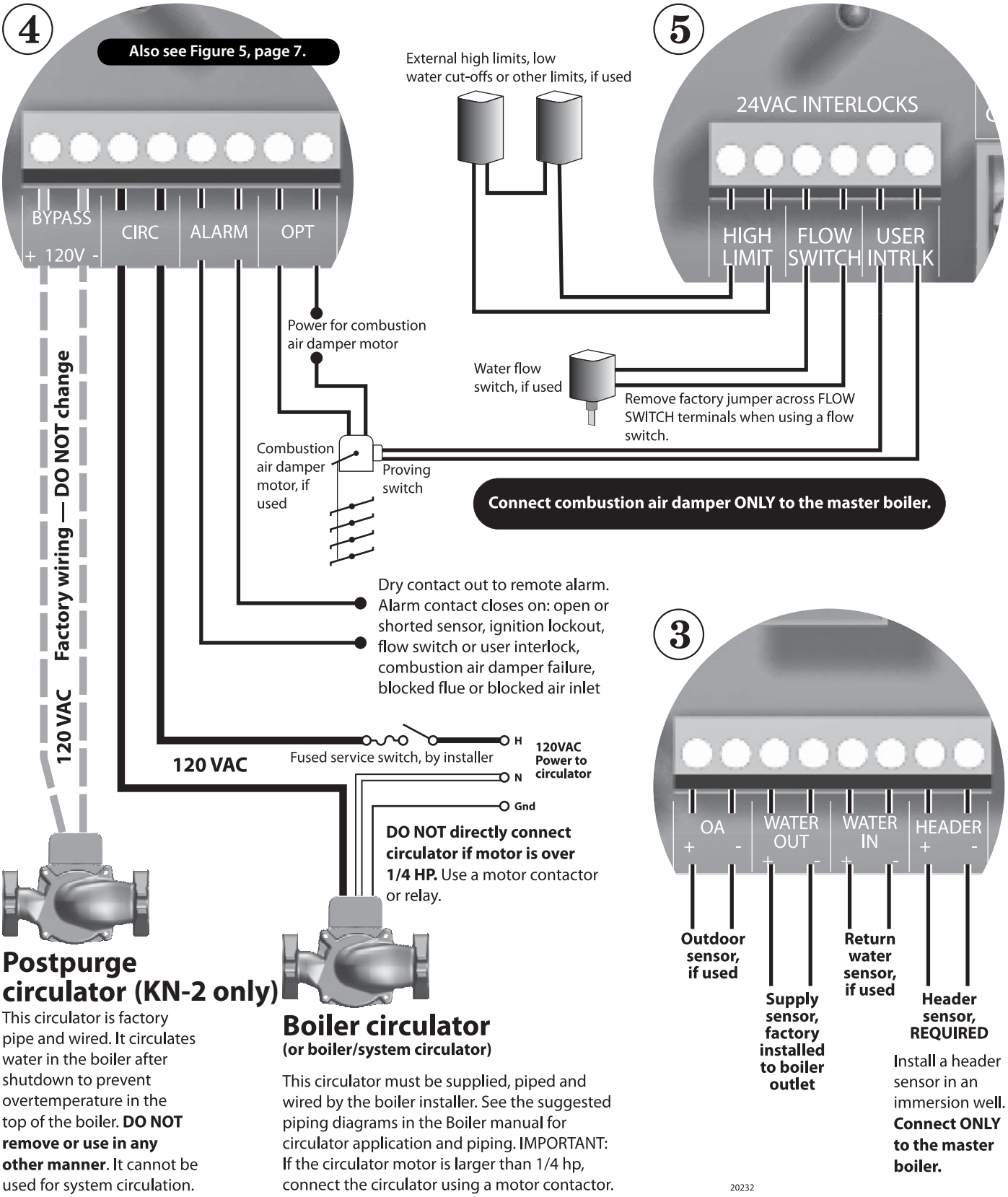
**Master boiler: Room thermostats, end switches or relay contacts**
(Connect thermostat, zone valve end switches, or remote start relay contact here. Test when done to ensure no stray voltage is present on any of the wires. See the Boiler manual for procedure.)
**Member boiler: Connect override contacts only**
(Individual boilers, if piped appropriately, can be activated for override operation, such as DHW heating or emergency space heating.)

**4-20mA input option — for remote setpoint control ONLY**
(Connect remote temperature control 4-20mA input wires here when **remote setpoint** is required. Setpoint temperature will equal milliamps/0.09; example: 11 mA would cause a setpoint of 11/0.90 = 122°F.)

20230

# 1 Method 1: HeatNet modulation – local control *(cont.)*

**Figure 8** KN wiring summary — wiring to electrical connection board, continued (see Figure 7, page 9, for terminal strip locations)


4
Also see Figure 5, page 7.
BYPASS
+ 120V -
CIRC
ALARM
OPT
5
External high limits, low water cut-offs or other limits, if used
24VAC INTERLOCKS
HIGH LIMIT
FLOW SWITCH
USER INTRLK
Power for combustion air damper motor
Water flow switch, if used
Remove factory jumper across FLOW SWITCH terminals when using a flow switch.
Combustion air damper motor, if used
Proving switch
Connect combustion air damper ONLY to the master boiler.
120 VAC Factory wiring — DO NOT change
Dry contact out to remote alarm. Alarm contact closes on: open or shorted sensor, ignition lockout, flow switch or user interlock, combustion air damper failure, blocked flue or blocked air inlet
120 VAC
Fused service switch, by installer
H
N
Gnd
120VAC Power to circulator
DO NOT directly connect circulator if motor is over 1/4 HP. Use a motor contactor or relay.
3
OA
WATER OUT
WATER IN
HEADER
Outdoor sensor, if used
Supply sensor, factory installed to boiler outlet
Return water sensor, if used
Header sensor, REQUIRED
Install a header sensor in an immersion well. Connect ONLY to the master boiler.
20232

## Postpurge circulator (KN-2 only)

This circulator is factory pipe and wired. It circulates water in the boiler after shutdown to prevent overtemperature in the top of the boiler. **DO NOT remove or use in any other manner**. It cannot be used for system circulation.

## Boiler circulator

**(or boiler/system circulator)**

This circulator must be supplied, piped and wired by the boiler installer. See the suggested piping diagrams in the Boiler manual for circulator application and piping. IMPORTANT: If the circulator motor is larger than 1/4 hp, connect the circulator using a motor contactor.



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# 1 Method 1: HeatNet modulation – local control *(cont.)*

## External interlocks

1. Wire external limits and flow switch, when used, as shown in Figure 8, page 10.
2. If wiring to and from a motorized combustion air damper, follow the guidelines given in Figure 8, page 10. Connect only to the master boiler.

**CAUTION** If any of the member boilers is to operate in override mode, and the system is equipped with a combustion air damper, you must provide special wiring in order to ensure the damper opens and proves when the boiler fires. This must be done without compromising the wiring between the master boiler and the damper.

## Overrides — Control priorities

3. The KN control can provide override operation for any or all member boilers in a HeatNet network. This requires the boilers be piped with appropriate isolation piping and controls.
4. Override is done by closing a contact across the Heat Demand or DHW Demand terminals of any boiler. These priority inputs override all network controls or 4-20mA input controls to the boiler.
5. **DHW Demand** — The DHW Demand closure takes priority for ALL boilers, including the master and all members. When DHW Demand closes, the boiler or boilers immediately switch to DHW operation, including setting the water temperature to the DHW Setpoint.
6. **Space heating, Heat Demand** — If any member boiler sees closure across its Heat Demand terminals it will begin operation in space heating mode independently of commands from the master boiler or 4-20mA input source.

**CAUTION** Do not wire boilers for override operation unless the piping design provides automatic isolation of the overriding boilers. The master boiler would be unable to properly control system water temperature if member boilers were to input heat to the system without control from the master. DHW operation, in particular, would raise the supply temperature from overriding boilers to the DHW Setpoint.

**NOTICE** Override operation control setup — Boilers must be set up with operating parameters necessary during their override operation; i.e., local setpoint, DHW setpoint, etc.

7. Summary — priority sequence is:

**Priority 1 = DHW Demand**

**Priority 2 = Heat Demand**

**Priority 3 = HeatNet input**

## Set termination DIP switches

1. The HeatNet network needs to recognize the beginning and end of the network. This requires setting the four DIP switches on each boiler's electrical connection board.
2. See Figure 9 for location of the switches.
3. See Table 1 for required settings. The table gives settings for HeatNet modulation — local control and for remote control from a building management system (Modbus protocol).
4. DO NOT connect the communications cables (or shielded wires) between boilers until all boilers have had parameters set and then been started up following all instructions in the KN Boiler manual.

**Figure 9** Termination DIP switches (see item 7, Figure 7, page 9 for location)

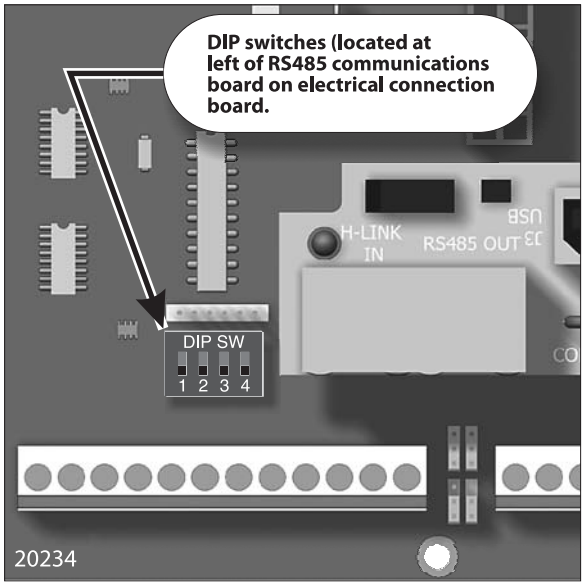


**Table 1** Termination DIP switch settings

| Boiler | HeatNet | Modbus (see note) |
|---|---|---|
| Master | Switch 1: ON<br>Switch 2: ON<br>Switch 3: OFF<br>Switch 4: OFF | Switch 1: ON<br>Switch 2: ON<br>Switch 3: ON<br>Switch 4: ON |
| Last member | Switch 1: ON<br>Switch 2: ON<br>Switch 3: OFF<br>Switch 4: OFF | Switch 1: ON<br>Switch 2: ON<br>Switch 3: OFF<br>Switch 4: OFF |
| Other members | Switch 1: OFF<br>Switch 2: OFF<br>Switch 3: OFF<br>Switch 4: OFF | Switch 1: OFF<br>Switch 2: OFF<br>Switch 3: OFF<br>Switch 4: OFF |

Note: Modbus setup is for applications controlled by a building management system. For systems using BACnet or LonWorks, a bridge board is used to interface with the KN-2 control. The switch is "on" when in the down position and "off" when in the up position.

# 1 Method 1: HeatNet modulation – local control *(cont.)*

**WARNING** **Close the external manual gas valve on every boiler** before proceeding. DO NOT open any gas valve, or attempt to fire any boiler, until the boilers have been set up and verified following the instructions in the KN Boiler manual.

Failure to comply could cause a boiler failure, leading to possible severe personal injury, death or substantial property damage.

## Set control parameters on keypads

**NOTICE** Before turning boilers on to set parameters, disconnect all call for heat wiring at the electrical connection boards. This will prevent the boiler for attempting to cycle during the setup process.

1. See "Control menus and adjustments," beginning on page 22 for a complete list of control parameters and explanations.
2. Carefully read the parameter explanations in Table 8, page 25 through page 29.
3. When adjusting the limit band, operating limit (OP LIMIT), local setpoint (LOC SETPOINT) and DHW setpoint, make sure the operating temperature bands do not overlap or cause potential for nuisance cycling.
4. Indoor air reset — Use this option whenever possible. The indoor air technology monitors space heating demand to help the boiler operate at the highest possible efficiency throughout the season. To operate with IAR, you must wire to the IAR input terminals as described on page 18.
5. System clock — Set the system clock on all boilers to ensure the time stamps will be accurate in the data logs.
6. Turn on the power to each boiler and set the on/off switch to ON as you set its parameters.
7. Use the boiler's keypad to enter the parameters as described on page 22.
8. After setting a boiler's parameters, turn the power off to the boiler until you are ready to start the boiler up following the Boiler manual instructions.
9. Set the master boiler and each member boiler, following the guidelines given in Table 2.

## Start up boilers per KN Boiler manual

1. Turn off power to all boilers.
2. Follow all instructions in the KN Boiler manual to start up each boiler and verify operation.

## Connect network cables

**WARNING** **Electrical shock hazard —** Turn off power to each boiler before attempting to connect the network cables.

**NOTICE** Before turning boilers on to check network operation, disconnect all call for heat wiring at the electrical connection boards. This will prevent the boiler for attempting to cycle during the setup process.

### Master boiler cable

1. Connect an RJ45 cable to the master boiler H-Link OUT block (item 2, Figure 10, page 13) or 3-wire shielded cable to the H-Link terminal strip (item 4, Figure 10, page 13). The other end of this cable will be attached to the first member boiler in following steps.

**Table 2** Control parameters

| Parameter | Master boiler | Member boiler (see notes) |
|---|---|---|
| HEAT BAND | Set on master boiler only | |
| LOC SETPOI NT | Set | HD only[1] |
| SOURCE | Set | HD or DHW only[1,2] |
| DHW SETPOINT | Set if DHW will be used | DHW only[2] |
| OP LIMIT | Set | Set |
| LIMIT BAND | Set | Set |
| IA RESET | ON if IAR is used, or set to OFF | Do not set |
| OA SHUTDOWN | Set ON if used or set to OFF | HDOA only[3] |
| OA SETPOINT | Set if used | HDOA only[3] |
| OA RESET | Set if used | HDOA only[3] |
| OA SETPTS | Set if used | HDOA only[3] |
| DELTA ENABLE | Set if used | Set if used |
| DELTA TEMP | Set if used | Set if used |
| PURGE TIME | Set if used | Set if used |
| ALWAYS ON | Set if used | Set if used |
| MASTER PUMP | Set if used | Do not set |
| NIGHT SETBACK | Set on master boiler only | |
| OPTIONS (all) | Set | Set |
| AUX FUNCTIONS | Set on master boiler only | |
| SYSTEM CLOCK | Set | Set |
| LOCAL ADD | Automatic | Set (beginning at 2) |
| CONSOLE ADD | Automatic | Set (beginning at 2) |
| MODULAR BOILER | Set on master boiler only | |
| MODULATION PID | Set on master boiler only | |
| FIRING MODE | Set on master boiler only | |
| SENSOR # | Set | HD/HDOA only[1,3] |
| TYPE | Set | HD/HDOA only[1,3] |
| CALIBRATE ? | On any boiler if required | |
| PASSWORD | Set | Set |
| COMMUNICATIONS | Set | Set |
| LOAD DEFAULTS | On any boiler if required | |
| SYSTEM | On any boiler if required | |

Notes:

**1 — HD Only** means to set the parameter for a member boiler only if it is wired for Heat Demand override.

**2 — DHW Only** means to set the parameter for a member boiler only if it is wired for DHW Demand override.

**3 — HDOA Only** means to set these parameters only if the member boiler will be operated with outdoor reset when put in override mode with closure across its Heat Demand terminals (requires outdoor sensor connected to boiler).



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# 1 Method 1: HeatNet modulation – local control *(cont.)*

2. Turn on power to the master boiler and set its on/off switch to ON.
3. You should hear at least 2 beeps.
4. The control's firmware version number will display.
5.

After the control's timer finishes, the display will show STANDBY and SYS SET. This verifies that the master boiler is setup correctly as the master. The same display will show on member boilers when there is a call for heat from the master boiler. When there is no call for heat at a member boiler, the display will show LOC SET instead.
6. If the master is functioning correctly, the yellow LED's on the H-Link jack ports will blink. The blinking indicates that the master is trying to communicate with member boilers.
7. If a FAULT message is displayed, clear the faults until the STANDBY message is displayed. Refer to troubleshooting suggestions at the end of this manual if you cannot resolve the issue.

## Member boiler cables

1. Begin with the first member boiler.
2. Plug the other end of the master boiler's communications cable to the member boiler's input port (Figure 10, page 13, item 2 for RJ45 cable or item 4 for 3-wire cable).
3. Connect cables to all of the member boilers by cabling from one to the next. Connect incoming cables to item 1 or 4, Figure 10, page 13. Connect outgoing cables to item 2 or 4. (Note that shielded cable wires will share terminals when using item 4.)

## Check the network

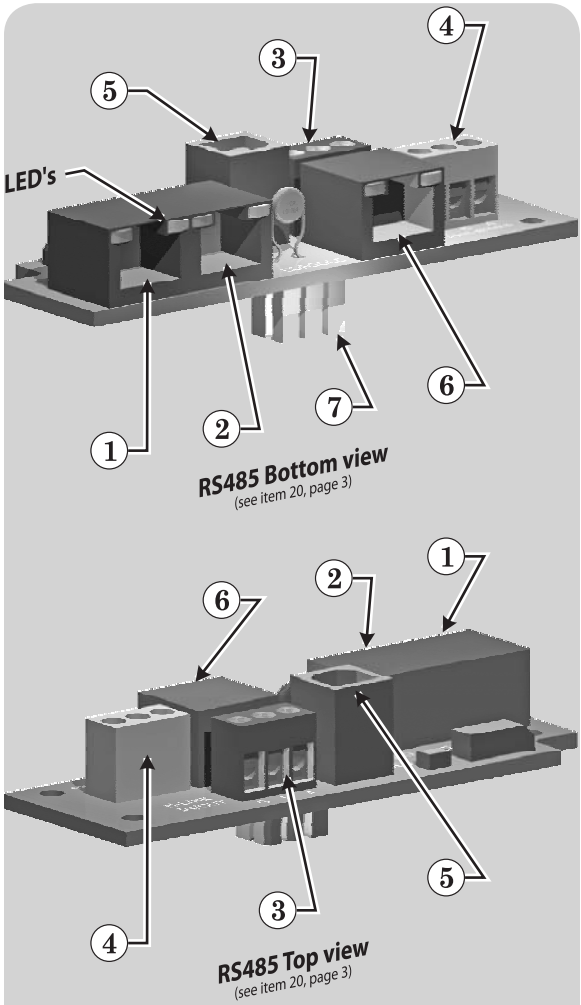
1. Turn the power on and the on/off switch to ON for all of the member boilers.
2. Allow time for each boiler to initialize.
3. After about 30 seconds, the master boiler should recognize the member boilers.
4.

Navigate to the BOILERS menu, then to HEAT NET BOILERS display. The master control will show the boilers it recognizes. Values from 10 to 15 will display as letters (10=A, 11=B, 12=C, 13=D, 14=E and 15=F).
5. If the display shows a blank space, such as "123_56789ABC," the control does not detect the missing boiler (boiler 4). Check the yellow LED on the communication port of the missing boiler.
6. NORMAL connection — LED should flash steadily, about twice per second.
7. TERMINATION incorrect — LED will flash rapidly and stay on.
8. OPEN connection — LED does not flash at all.
9. If a FAULT message is displayed, clear the faults until the STANDBY message is displayed. Refer to troubleshooting suggestions at the end of this manual if you cannot resolve the issue.

## Start the system

1. Turn off power to all boilers.
2. Connect all call for heat wiring to the boilers.
3. Turn on power to all boilers and turn the on/off switches to ON.
4. The boilers should now operate normally, as described in the Boiler manual.
5. The master boiler will sequence and modulate boilers as necessary to control the water temperature.
6. The master boiler will show the number of boilers firing as well as the temperature and heat band display. Use the UP/DOWN keys to scroll through the displays to watch the process of starting and stopping boilers.

**Figure 10** RS485 communications board




1. RJ45 HeatNet cable IN from master or previous member
2. RJ45 HeatNet cable OUT to next member boiler
3. Shielded wire (3-2ire), option to RJ45 cable, HeatNet communications INPUT and connection for additional boilers on the network
4. Shielded wire (option to RJ45 cable) Modbus INPUT from building management system
5. USB cable port (for USB cable connection to a PC — required when updating control firmware)
6. RJ45 cable from building management system, when used
7. Plug for insertion into KN control electrical connection panel (see page 3)
8. NOT SHOWN — An optional plug-in bridge is required to interface with building management systems that use BACnet or LonWorks protocol. The KN control supports Modbus protocol with no additional components except the RS485 interface board.

# 2 Method 2: HeatNet modulation – BMS control

## Overview

1. This method uses an RS485 digital communications cable with the Modbus protocol to control a boiler or HeatNet network.

2. The boiler or boiler network will operate as in the HeatNet local control method (Section 1 of this manual). But, instead of the HEAT DEMAND input, a software form of the HEAT DEMAND input is used (address 40001 — Boiler/System Enable/Disable).

3. The System Setpoint Timer needs to be loaded periodically to allow the HeatNet system to revert to local control from the master boiler in the event communications is lost.

4. The Modbus protocol allows writing and reading registers using Modbus commands. An optional BACnet or LonWorks bridge module can be used to connect the Modbus network to a BACnet or LonWorks network.

5. This method allows enabling and disabling the boiler or HeatNet system; changing setpoints; and reading boiler status or temperatures remotely, using digital commands from a Building Management System.

6. The master boiler assumes the role of MEMBER, RTU, 192Kb, 8 bits, Even Parity, 1 stop bit, when connected to a BMS.

7. The Member Boilers should not be connected to a BMS system other than to view read-only addresses.

## MODBUS registers

1. See Table 3, page 14; Table 4, page 14; and Table 5, page 15 for register requirements.

2. The system setpoint timer and system setpoint work in tandem to externally control the operating setpoint.

3. The setpoint (countdown) timer should be loaded with a timeout value (in seconds) prior to writing the system setpoint.

4. When the timer reaches zero, the control assumes that the BMS is no longer operating and the local setpoint (saved on the master control) is reloaded.

5. This is a fail-safe feature used to help safeguard the system in case of BMS failure.

6. If the setpoint timer is not written, a default timeout value of 60 seconds is assumed.

7. To write the system clock, registers 40009 – 40015 must first be loaded with the correct date and time. Then, a 1 must be written to register 16 to write the date and time to the system clock.

**Table 3** Modbus holding (read/write) registers

| Address | Data Type | Description | Valid Values/ Range |
|---|---|---|---|
| 40001 | Unsigned | Boiler/System Enable/Disable | 0 = Disabled/Off 1 = Enabled/On |
| 40002 | Unsigned | System Setpoint Timer (1) | 0 – 65535 seconds |
| 40003 | Unsigned | System Setpoint (1) | 40°F – 220 °F |
| 40004 | Unsigned | Outdoor Air Reset Enable/Disable | 0 = Disabled/Off 1 = Enabled/On |
| 40005 | Unsigned | Outdoor Air Setpoint | 40°F -100 °F |
| 40006 | Unsigned | Water Temperature at High Outside Air | 60°F -150 °F |
| 40007 | Unsigned | High Outside Air Temperature | 50°F -90 °F |
| 40008 | Unsigned | Water Temperature at Low Outside Air | 70°F -220 °F |
| 40009 | Signed | Low Outside Air Temperature | -35°F -40 °F |
| 40010 | Unsigned | Set Clock – Month (2) | 0 – 11 |
| 40011 | Unsigned | Set Clock – Day of Month (2) | 1 – 31 |
| 40012 | Unsigned | Set Clock – Year (2) | 0 – 99 |
| 40013 | Unsigned | Set Clock – Hours (2) | 0 – 23 |
| 40014 | Unsigned | Set Clock – Minutes (2) | 0 – 59 |
| 40015 | Unsigned | Set Clock – Seconds (2) | 0 – 59 |
| 40016 | Unsigned | Set Clock – Day of Week (2) | 1 – Monday 7 – Sunday |
| 40017 | Unsigned | Set Clock – After the Set Clock Registers listed above have been written, a 1 must be written to this location to set the clock. (2) | 1 |

**Table 4** Boiler status flags

| Bit | Description | Bit | Description |
|---|---|---|---|
| 0 | Disabled | 16 | Pilot Valve |
| 1 | Local Override | 17 | Blower |
| 2 | Alarm | 18 | Ignition Alarm |
| 3 | Failed | 19 | Valve Alarm |
| 4 | Member Error | 20 | High Limit |
| 5 | Boiler Running | 21 | Air Prove Switch |
| 6 | Pump Running | 22 | XS Factory |
| 7 | Spare 3 Interlock | 23 | Software Operator |
| 8 | LWCO Interlock | 24 | Header Sensor not Present |
| 9 | VFD Interlock | 25 | Supply Sensor not Present |
| 10 | Gas Prove | 26 | Return Sensor not Present |
| 11 | Spare 4 | 27 | Outside Air Sensor not Present |
| 12 | Operator Interlock | 28 | — — |
| 13 | Water Prove (Flow) Interlock | 29 | — — |
| 14 | Air Prove UV Sensor Interlock | 30 | Master Boiler |
| 15 | Main Valve | 31 | Present (Boiler Detected) |



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# 2 Method 2: HeatNet modulation – BMS control *(cont.)*

## BACnet or LonWorks protocols

1. Install the correct bridge to adapt to building management systems using BACnet or LonWorks protocols.
2. The bridge translates the BACnet or LonWorks input to the Modbus protocol for compatibility with the HeatNet controls.

## Wiring and set-up

1. Wire and set up the master boiler and member boilers exactly as for HeatNet modulation — local control applications. See page 6 through page 13.
2. ALL control parameters must be set up just as for the local control method.
3. The ONLY difference in setup is the termination DIP switch settings. Use the settings for Modbus communications given in Table 1, page 11.
4. Connect communications cables (RJ45 or shield-wire cables) between the control communications boards as for the local control method.
5. Verify network operation BEFORE connecting the building management system.

## Connect the BMS cable

1. DO NOT connect the building management system cable until the boiler network has been proven to operate independently. The system is designed to revert to local control by the master boiler should communications with the building management system be lost.
2. Turn off power to the master boiler.
3. See Figure 10, page 13. Connect an RJ45 cable to the BMS input port, item 6. Or use shielded wire cable, connected to terminal block, item 3.

## Verify BMS/HeatNet operation

1. Turn on power to the master boiler.
2. Allow the master boiler to initialize.
3. Verify operation with the building management system.

**Table 5** Modbus input (read-only) registers

| Address | Data Type | Description | Valid Values/ Range |
|---|---|---|---|
| 30001 | Unsigned | Boilers Running | 0 – 16 |
| 30002 | Unsigned | Modulation (% BTU Load) | 0 – 100 |
| 30003 | Signed | Header / System Temperature | 32 – 250 °F |
| 30004 | Signed | Supply Temperature | 32 – 250 °F |
| 30005 | Signed | Return Temperature | 32 – 250 °F |
| 30006 | Signed | Outside Air Temperature | -40 – 250 °F |
| 30007 | Signed | Spare Input 1 | -32768 to 32767 |
| 30008 | Signed | Spare Input 2 | -32768 to 32767 |
| 30009 | Unsigned | Clock – Month | 0 – 11 |
| 30010 | Unsigned | Clock – Day | 1 – 31 |
| 30011 | Unsigned | Clock – Year | 0 – 99 |
| 30012 | Unsigned | Clock – Hours | 0 – 23 |
| 30013 | Unsigned | Clock – Minutes | 0 – 59 |
| 30014 | Unsigned | Clock – Seconds | 0 – 59 |
| 30015 | Unsigned | Clock – Day of Week | 1 – Monday 7 – Sunday |
| 30016 – 30047 | Unsigned | Boilers 1 – 16 status flag (32-bit) registers. The upper 16-bits of each 32-bit register is stored at odd numbered addresses 30016 –30046. The lower 16-bits of each 32-bit register is stored at even numbered addresses 30017 – 30047. | See the Boiler Status Flags Table Below |
| 30048 – 30079 | Unsigned | Boilers 1 – 16 runtime (32-bit) registers. The upper 16-bits of each 32-bit register is stored at odd numbered addresses 30048 – 30078. The lower 16-bits of each 32-bit register is stored at even numbered addresses 30049 – 30079. When the upper and lower registers are combined they form a 32-bit unsigned integer that is the number of seconds that the boiler has been running. For instance: (((Register 29) * 65536) + Register 30) = Boiler 1 runtime in seconds. Boiler 1 is the master boiler. Boilers 2 – 16 are member boilers. | 0 – 4294967295 seconds |

# 3 Method 3: External 4-20ma control

**WARNING** **Electrical shock hazard —** Disconnect all electrical power sources to the boiler before making any electrical connections.

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation! Verify proper operation after servicing.

Failure to comply with the above could result in severe personal injury, death or substantial property damage.

**NOTICE** The electrical connections to this boiler must be made in accordance with all applicable local codes and the latest revision of the National Electrical Code, ANSI /NFPA-70. Installation should also conform to CSA C22.1 Canadian Electrical Code Part I if installed in Canada. Install a separate 120 volt 15 amp circuit for the boiler. A properly rated shut-off switch should be located at the boiler. The boiler must be grounded in accordance with the authority having jurisdiction, or if none, the latest revision of the National Electrical Code, ANSI/NFPA-70.

Line voltage field wiring of any controls or other devices must use copper conductors with a minimum size of #14 awg. Use appropriate wiring materials for units installed outdoors.

## Overview — control setup sequence

**CAUTION** **Follow the Boiler manual** — Install the boilers according to the KN Boiler manual before attempting to set up the control system.

1. This method can be used for from 1 to 5 boilers.
2. Install all boilers per the Boiler manual.
3. Close the external gas valve on every boiler.
4. Wire all boilers following the guidelines in this section.
5. DO NOT install a header sensor on any of the boilers.
6. Disconnect the wires to the boilers' Remote Enable terminals (and any override wiring to Heat Demand or DHW Demand terminals) to ensure there will be no call for heat while proceeding.
7. Set the boilers' control parameters using their display/keypads.
8. Follow the instructions in the Boiler manual to start up each boiler before proceeding further.
9. Finish by reconnecting call for heat wiring, then operating the complete system to verify operation in all modes.

## Connect 4-20mA wiring

1. See Figure 16, page 19 for wiring from the 4-20mA controller. The control must provide the 4-20mA signal and a contact for each boiler to enable its operation by closing across the Remote Enable contact.

## Power supply (120 VAC)

1. See Figure 11 and Figure 12.
2. Connect minimum 14awg copper wire to the power connection as shown in Figure 12.
3. Install a fused service switch, mounted and installed in accordance with all applicable codes.

**Figure 11** Electrical connection board (see item 10, page 3 for location — Also see the wiring summary illustrations on the next pages)

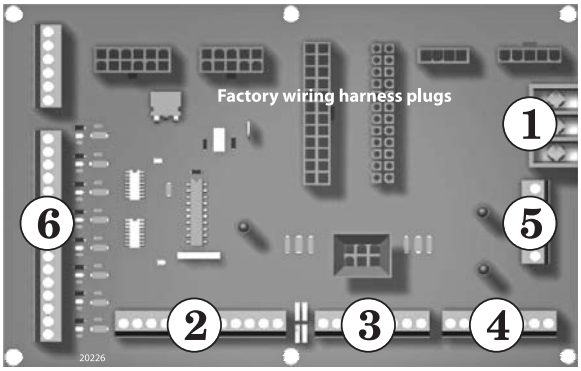
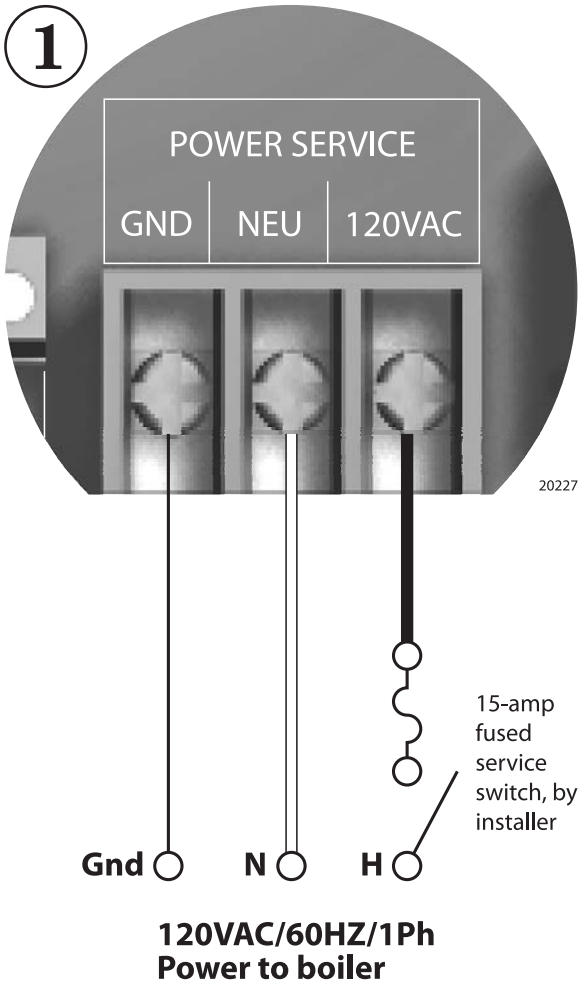



**Figure 12** 120VAC power service terminals on electrical connection board — See Figure 15 for location of the power terminal strip



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# Method 3: External 4-20ma control *(continued)*

## Circulator wiring

### Postpurge circulator (KN-2 only)

- **The circulator shipped installed with the boiler cannot be used for system circulation.** It must be used as supplied from the factory. It circulates water after the boiler stops firing to prevent potential damage from heat pocketing in the top of the heat exchanger.
- The postpurge circulator is factory-piped and pre-wired. Do not change the usage, the wiring, the location or the piping.

### Boiler circulator

- See the Boiler manual for circulator piping.
- Figure 13, Figure 14, and Figure 15 show wiring of the Boiler circulator (or boiler/system circulator) to the terminal strip of the KN-2 electrical connection board.
- DO NOT directly connect a circulator with a motor larger than 1/4 hp. For larger motors, install a circulator relay or motor contactor . Figure 13 and Figure 14 show the correct ways to install the boiler circulator using a relay or motor starter.

**Figure 13** Wiring the boiler circulator using a circulator relay (required for motors over 1/4 hp)

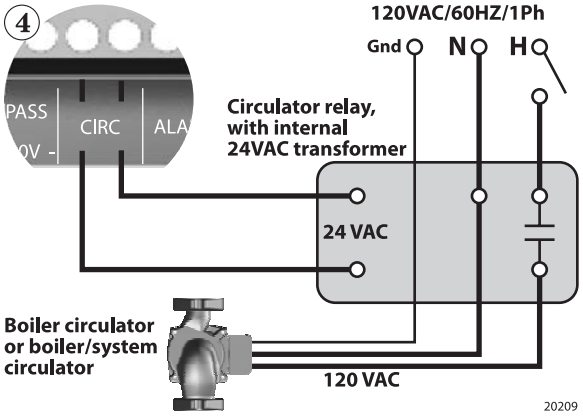



**Figure 14** Wiring the boiler circulator using a relay or starter (required for motors over 1/4 hp)

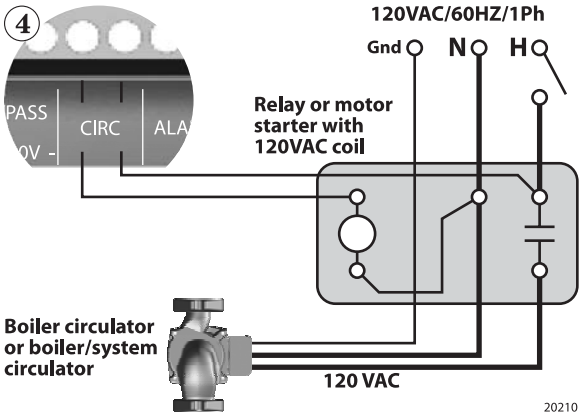
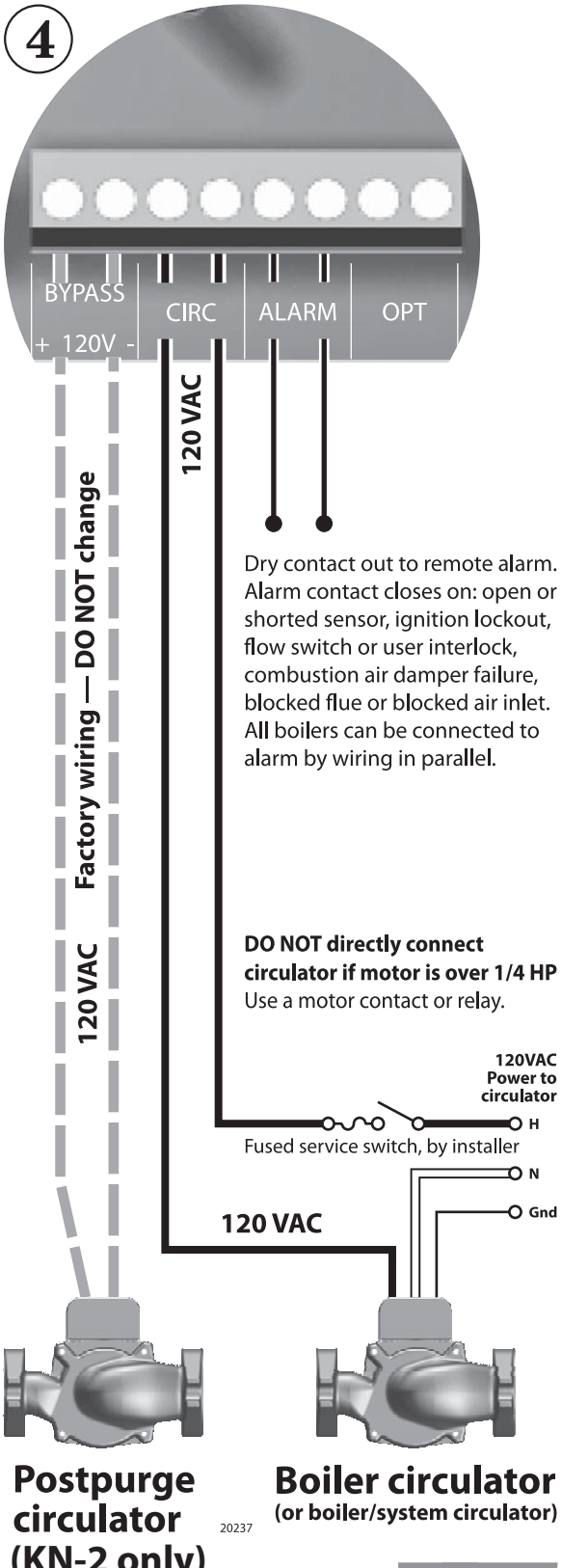



**Figure 15** Circulator wiring terminal strip (see Figure 11, page 16, for location) — Also see the wiring summary illustrations on the next pages)


4
BYPASS
CIRC
ALARM
OPT
+ 120V -
120 VAC
Factory wiring — DO NOT change
120 VAC
Dry contact out to remote alarm. Alarm contact closes on: open or shorted sensor, ignition lockout, flow switch or user interlock, combustion air damper failure, blocked flue or blocked air inlet. All boilers can be connected to alarm by wiring in parallel.
DO NOT directly connect circulator if motor is over 1/4 HP
Use a motor contact or relay.
120VAC Power to circulator
H
Fused service switch, by installer
N
Gnd
120 VAC
Postpurge circulator (KN-2 only)
Boiler circulator (or boiler/system circulator)
20237

3

# Method 3: External 4-20ma control *(continued)*

## 4-20mA operation

1. A 4.02 mA current signal will start the boiler, at low fire. A 20mA signal will cause the boiler to go to full input.
2. Between these input signal limits, the boiler modulates. The boiler firing rate percentage is equal to the percentage of the signal between 0 and 20 mA. Example, a signal of 12 mA is 60% of 20 mA, so the boiler firing rate would be 60% of max.
3. In addition to the 4-20mA signal, the remote controller must also close a contact across each boiler's Remote Enable contact in order for the boiler to fire.
4. See Figure 16, page 19 for wiring. Notice that the boiler 4-20mA terminals are wired in series.

## IAR (Indoor Air Reset) wiring — apply ONLY if using space heating override mode

- IAR can only be used if one or more of the boilers is wired and piped for override operation. Override would occur when a contact closed across the Heat Demand terminals. While this contact is closed, the boiler will operate based on local control, including feedback for IAR if wired.
- If override operation will be used, and you want to operate with IAR when in override mode, follow the instructions under Method 1 in this manual to wire for IAR.

## Sensor wiring

- **Header sensor cannot be used when the boilers are configured for remote operation by a 24-mA source.**
- **Outdoor reset application can be done only in override mode** — To operate with outdoor reset, purchase and install an outdoor sensor. Mount the sensor such that it is shielded from direct sunlight if possible and not likely to be covered by snow drifts or debris. Connect the outdoor sensor leads to the master boiler's electrical connection board as shown in Figure 8, page 10. (Member boilers could have their own outdoor sensor if they will be operated in override mode by closing the Heat Demand terminals.)
- **Return water temperature sensor** — The return water temperature sensor is optional, only needed if you want to automatically control the boiler postpurge pump cycle time. Install the sensor in a well in the boiler return piping. Connect the sensor leads to the electrical connection board as shown in Figure 8, page 10. Each boiler requires a return water temperature sensor.

## DHW wiring — ONLY if using DHW override mode

- **The boiler (or boilers) must be piped with isolation valves and wired for override operation**. Override of the 4-20mA input will occur if a contact closes across the boiler's DHW Demand terminals.
- To operate the boiler for domestic water heating with a storage tank, install and pipe the tank according to the tank manufacturer's instructions and the recommended piping diagrams in this manual. Consult the factory for applications not covered.
- The circulator used for DHW must be operated by a circulator relay or zone controller that is activated when the tank aquastat calls for heat.
- Connect the tank aquastat terminals across the DHW DEMAND terminals on the master boiler's electrical connection board as shown in Figure 7, page 9. (Member boilers could be connected to tank aquastats if they are piped appropriately and intended to operate in override mode.)External interlocks

5. Wire external limits and flow switch, when used, as shown in Figure 17, page 20.
6. The combustion air interlocks cannot be used when operating with a 24-mA remote control. Combustion air damper control must be done by the remote control system.

## Overrides — Control priorities

1. The KN control can provide override operation for any or all member boilers. This requires the boilers be piped with appropriate isolation piping and controls.
2. Override is done by closing a contact across the Heat Demand or DHW Demand terminals of any boiler. These priority inputs override all 4-20mA input controls to the boiler.
3. **DHW Demand** — The DHW Demand closure takes priority for ALL boilers, including the master and all members. When DHW Demand closes, the boiler or boilers immediately switch to DHW operation, including setting the water temperature to the DHW Setpoint.
4. **Space heating, Heat Demand** — If any member boiler sees closure across its Heat Demand terminals it will begin operation in space heating mode independently of commands from the 4-20mA input source.

**CAUTION** Do not wire boilers for override operation unless the piping design provides automatic isolation of the overriding boilers.

**NOTICE** Override operation control setup — Boilers must be set up with operating parameters necessary during their override operation; i.e., local setpoint, DHW setpoint, etc.

5. Summary — priority sequence is:

**Priority 1 = DHW Demand**

**Priority 2 = Heat Demand**

**Priority 3 = 4-20mA Input/Enable**



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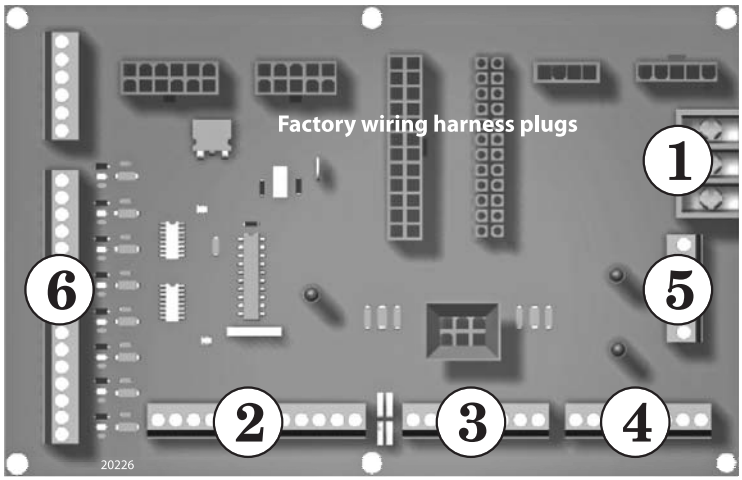
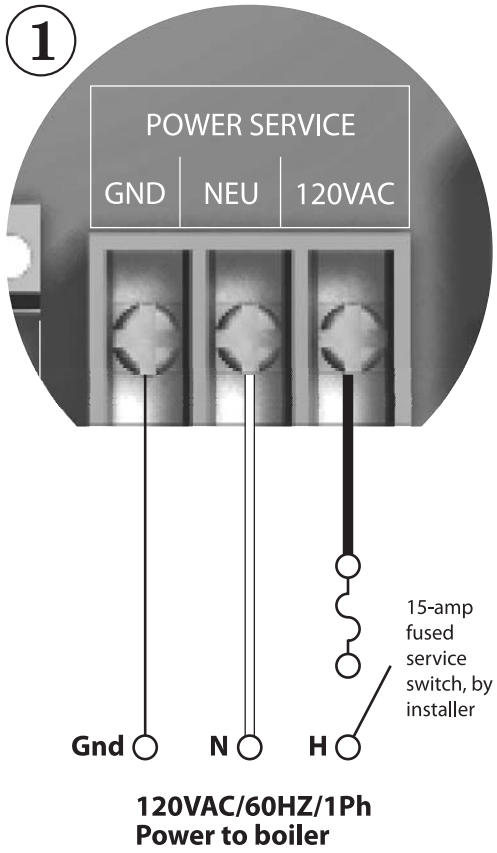
# 3 Method 3: External 4-20ma control *(continued)*

**Figure 16** KN wiring summary — wiring to electrical connection board

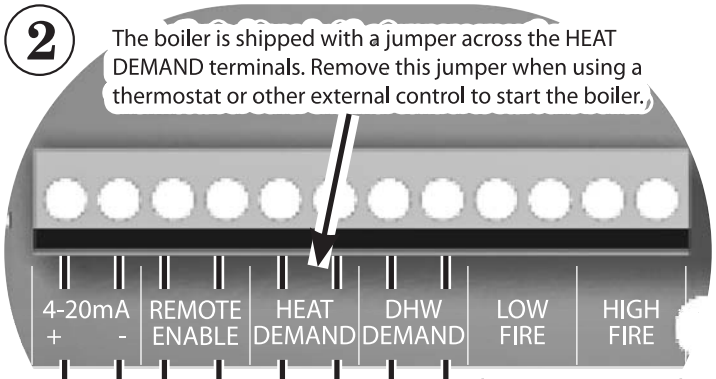



**Electrical connection board**

(Located in center panel on boiler right side)




**120VAC/60HZ/1Ph Power to boiler**


2
The boiler is shipped with a jumper across the HEAT DEMAND terminals. Remove this jumper when using a thermostat or other external control to start the boiler.
4-20mA + -
REMOTE ENABLE
HEAT DEMAND
DHW DEMAND
LOW FIRE
HIGH FIRE

Use these terminals only during boiler setup as given in the Boiler manual

**Use ONLY if wiring and piping for Override mode:**
**DHW tank aquastat, when used**
(A DHW circulator and circulator relay will be required. Start the DHW circulator on call for heat from the tank aquastat.)

**To remote controller enable contact (1 per boiler)**

**Use ONLY if wiring and piping for Override mode:**
(Connect thermostat, zone valve end switches, or remote start relay contact here. Test when done to ensure no stray voltage is present on any of the wires. See the Boiler manual for procedure.)

**4-20mA input signal (see right for wiring)**

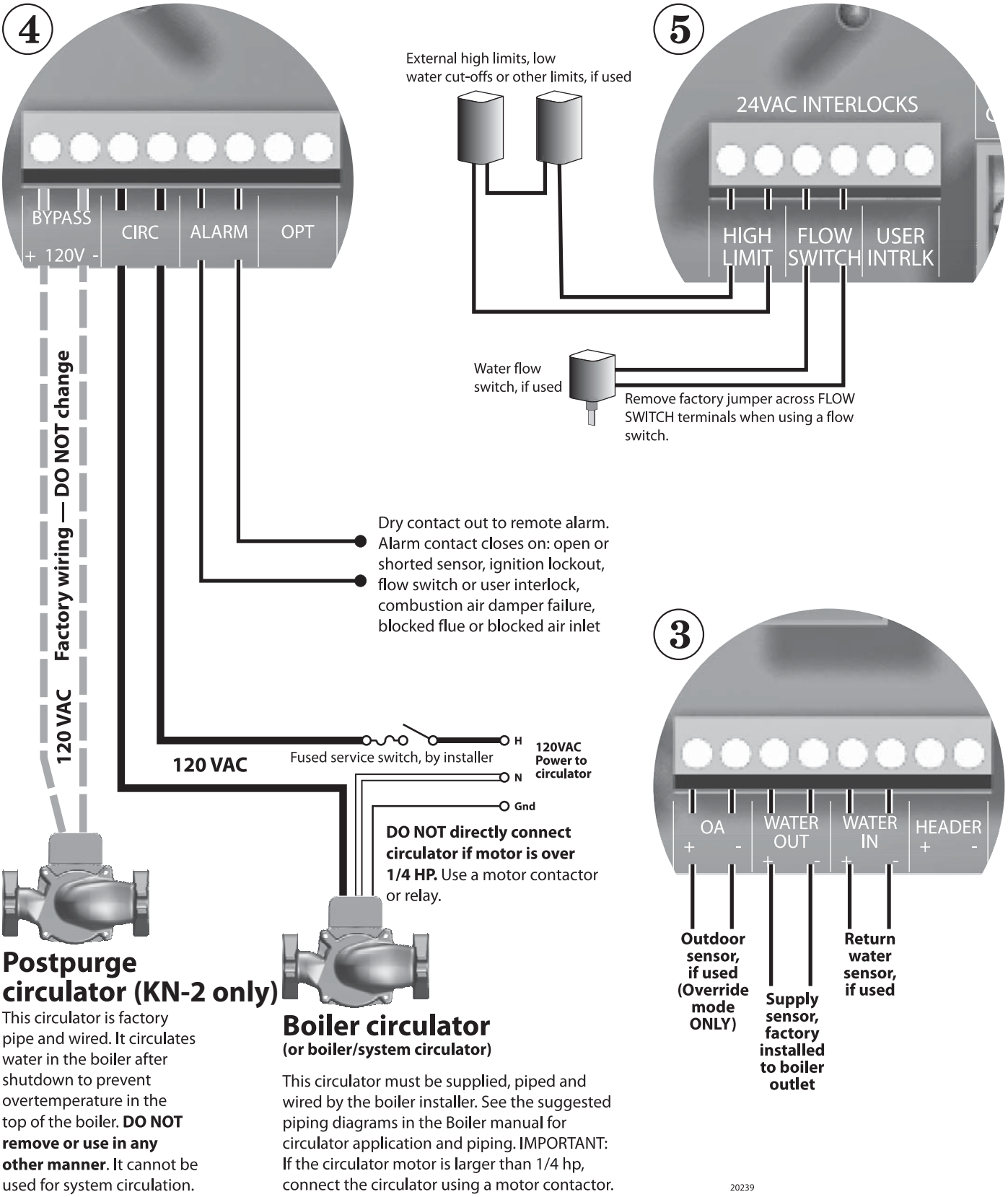
**The resistive load across the 24mA source is 250 ohms per boiler.**

**4-20mA Input**

20238

# 3 Method 3: External 4-20ma control *(continued)*

**Figure 17** KN wiring summary — wiring to electrical connection board, continued (see Figure 7, page 9, for terminal strip locations)


4
BYPASS
+ 120V -
CIRC
ALARM
OPT
5
External high limits, low water cut-offs or other limits, if used
24VAC INTERLOCKS
HIGH LIMIT
FLOW SWITCH
USER INTRLK
Water flow switch, if used
Remove factory jumper across FLOW SWITCH terminals when using a flow switch.
Factory wiring — DO NOT change
120 VAC
Dry contact out to remote alarm. Alarm contact closes on: open or shorted sensor, ignition lockout, flow switch or user interlock, combustion air damper failure, blocked flue or blocked air inlet
120 VAC
Fused service switch, by installer
H
N
Gnd
120VAC Power to circulator
DO NOT directly connect circulator if motor is over 1/4 HP. Use a motor contactor or relay.
3
OA
WATER OUT
WATER IN
HEADER
Outdoor sensor, if used (Override mode ONLY)
Supply sensor, factory installed to boiler outlet
Return water sensor, if used
20239

## Postpurge circulator (KN-2 only)

This circulator is factory pipe and wired. It circulates water in the boiler after shutdown to prevent overtemperature in the top of the boiler. **DO NOT remove or use in any other manner**. It cannot be used for system circulation.

## Boiler circulator

**(or boiler/system circulator)**

This circulator must be supplied, piped and wired by the boiler installer. See the suggested piping diagrams in the Boiler manual for circulator application and piping. IMPORTANT: If the circulator motor is larger than 1/4 hp, connect the circulator using a motor contactor.



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# 3 Method 3: External 4-20ma control *(continued)*

**WARNING** **Close the external manual gas valve on every boiler** before proceeding. DO NOT open any gas valve, or attempt to fire any boiler, until the boilers have been set up and verified following the instructions in the KN Boiler manual.

Failure to comply could cause a boiler failure, leading to possible severe personal injury, death or substantial property damage.

## Set control parameters on keypads

**NOTICE** Before turning boilers on to set parameters, disconnect all call for heat wiring at the electrical connection boards, including the wiring to the boilers' Remote Enable terminals. This will prevent the boiler for attempting to cycle during the setup process.

1. See "Control menus and adjustments," beginning on page 22 for a complete list of control parameters and explanations.
2. Carefully read the parameter explanations in Table 8, page 25 through page 29.
3. When adjusting the limit band, operating limit (OP LIMIT), local setpoint (LOC SETPOINT) and DHW setpoint, make sure the operating temperature bands do not overlap or cause potential for nuisance cycling.
4. System clock — Set the system clock on all boilers to ensure the time stamps will be accurate in the data logs.
5. Turn on the power to each boiler and set the on/off switch to ON as you set its parameters.
6. Use the boiler's keypad to enter the parameters as described on page 22.
7. After setting a boiler's parameters, turn the power off to the boiler until you are ready to start the boiler up following the Boiler manual instructions.

## Start up boilers per KN Boiler manual

1. Turn off power to all boilers.
2. Follow all instructions in the KN Boiler manual to start up each boiler and verify operation.

## Start the system

1. Turn off power to all boilers.
2. Connect all call for heat wiring to the boilers.
3. Turn on power to all boilers and turn the on/off switches to ON.
4. The boilers should now operate normally, as described in the Boiler manual.
5. The remote 4-20mA controller will sequence and modulate boilers as necessary to control the water temperature.

**Table 6** Control parameters

| Parameter | When to set (see notes) |
|---|---|
| HEAT BAND | Set |
| LOC SETPOINT | HD only[1] |
| SOURCE | HD only[1] |
| DHW SETPOINT | DHW only[2] |
| OP LIMIT | Set |
| LIMIT BAND | Set |
| IA RESET | HD only[1] |
| OA SHUTDOWN | HD or HDOA only[1,3] |
| OA SETPOINT | HD or HDOA only[1,3] |
| OA RESET | HDOA only[3] |
| OA SETPTS | HDOA only[3] |
| DELTA ENABLE | Set if used |
| DELTA TEMP | Set if used |
| PURGE TIME | Set if used |
| ALWAYS ON | Set if used |
| MASTER PUMP | Set as required |
| NIGHT SETBACK | HD only[1] |
| OPTIONS (all) | Set |
| AUX FUNCTIONS | DO NOT use |
| SYSTEM CLOCK | Set |
| LOCAL ADD | DO NOT use |
| CONSOLE ADD | DO NOT use |
| MODULAR BOILER | DO NOT use |
| MODULATION PID | DO NOT use |
| FIRING MODE | DO NOT use |
| SENSOR # | HD/HDOA only[1,3] |
| TYPE | HD/HDOA only[1,3] |
| CALIBRATE ? | Only as required |
| PASSWORD | Set |
| COMMUNICATIONS | Only as required |
| LOAD DEFAULTS | Only as required |
| SYSTEM | Only as required |

Notes:

**1 — HD Only** means to set the parameter for a member boiler only if it is wired for Heat Demand override.

**2 — DHW Only** means to set the parameter for a member boiler only if it is wired for DHW Demand override.

**3 — HDOA Only** means to set these parameters only if the member boiler will be operated with outdoor reset when put in override mode with closure across its Heat Demand terminals (requires outdoor sensor connected to boiler).

# 4 Control menus and adjustments

## The Heat Net control display

### Starting the display

1. Check all wiring to make sure it is complete and all wires are securely connected.
2. Verify that the HEAT DEMAND and DHW DEMAND wires are removed.
3. Close the external gas valve on every boiler.
4. Turn on power to the boiler and then turn the boiler on/off switch ON.
5. The control will beep at least twice and the display will show the first STANDBY display in Figure 18. Note that pushing the DOWN button on the keypad will change the right side of the display as shown, providing information on various setpoints and parameters.
6. The display, LOC SET, means the setpoint temperature. Figure 18 shows the factory default values.

### Accessing setup menus

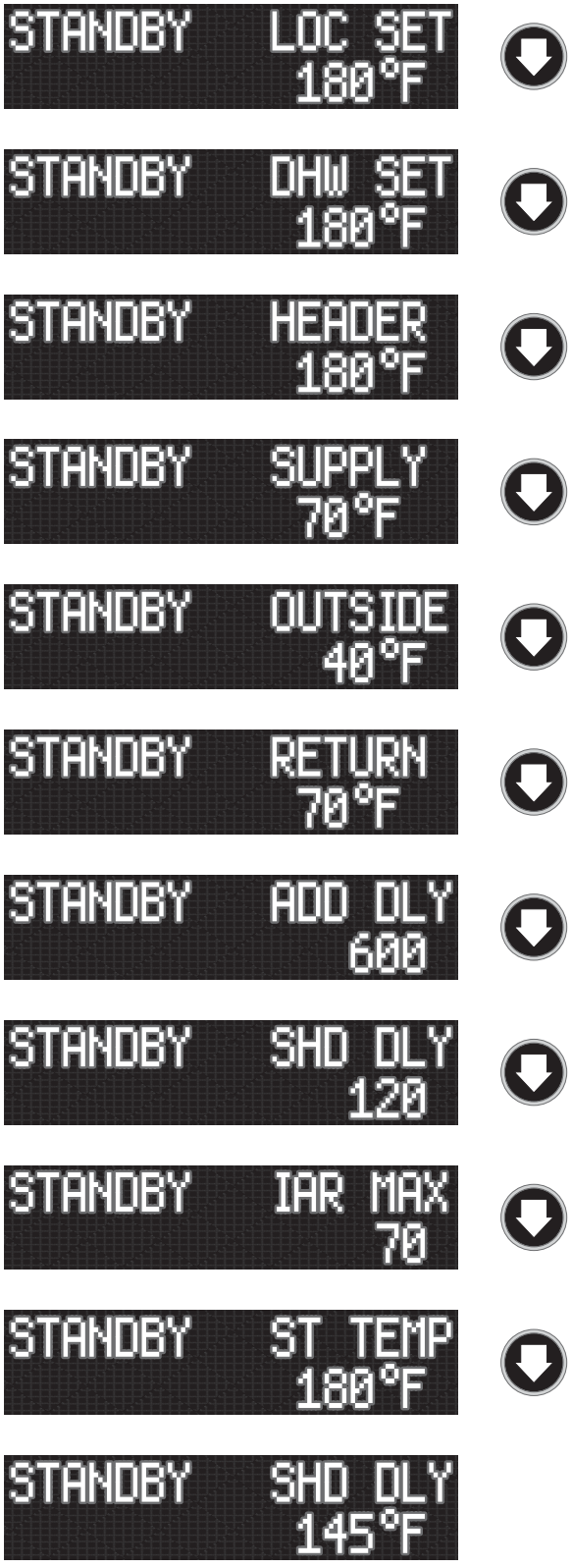
1. With the display in STANDBY, press and hold the BACK key for 5 seconds.
2. The display will change to:

3. Press the SELECT key to select setup. (Note that pressing the DOWN key would change the selection to VIEW LOG.)
4. The display will now show the first options in the setup menus:

5. Press the DOWN key to access additional menu options. Pressing the DOWN button once will change the display to:

6. The cursor moves to the second line, indicating this option could now be selected with the SELECT key.
7. Continuing to press the DOWN key will access these menu options:
   - **BOILERS**
   - **SETPOINTS**
   - **INDOOR AIR**
   - **PUMP OPTIONS**
   - **NIGHT SETBACK**
   - **OPTIONS**
   - **LOG/RUNTIME**
   - **AUX FUNCTIONS**
   - **SYSTEM CLOCK**
   - **ADVANCED SETUP**

**Figure 18** Heat Net display during Standby (no call for heat) — pressing the DOWN key on the keypad changes the display as shown



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# 4 Control menus and adjustments *(continued)*

**Table 7** Setup menus (*see Table 8, page 25 for explanations*)

To enter Setup: From STANDBY, hold BACK for 5 seconds. Then press SELECT with cursor on SETUP. Make sure there is no call for heat at the boiler before attempting to perform setup adjustments.

To return to STANDBY, press/release BACK until the display returns to standby, or turn boiler ON/OFF switch off, then on.

| Level 1<br>▲▼ next item<br>SELECT to select | Level 2<br>▲▼ next item<br>SELECT to select<br>BACK back one level | Level 3<br>▲▼ next item<br>SELECT to select<br>BACK back one level | Level 4<br>▲▼ next item<br>SELECT to select<br>BACK back one level | Default {Range}<br>▲▼ to change value<br>BACK to accept value and return to previous menu level | Typical line<br>(Display shows two lines at a time; cursor indicates active line) |
|---|---|---|---|---|---|
| KN-2 V X.X | | | | Shows firmware version number | KN-2 V 1.0 |
| BOILERS | # BOILERS | | | 1 {1 to 16} — display only | # BOILERS 1 |
| | LEAD BOILER | | | 1 — display only — the lead boiler is the boiler with a HEADER sensor connected | LEAD BOILER 1 |
| | HEAT BAND | | | 30 °F {10 to 50°F} | HEAT BAND 30°F |
| | HEAT NET BOILERS 123456789ABCDEFG | | | Display only — shows 1 through the number of boilers on the network | HEAT NET BOILERS 123456 |
| SETPOINTS | LOC SETPT | | | 180°F {140 to 180°F} | LOC SETPT 180°F |
| | SOURCE | | | AUTO {AUTO, 4-20MA} | SOURCE AUTO |
| | DHW SETPT | | | 180°F {140 to 180°F} | DHW SETPT 180°F |
| | OP LIMIT | | | 205°F {145 to 205°F} | OP LIMIT 215°F |
| | LIMIT BAND | | | 10°F {1 to 50°F} | LIMIT BAND 20°F |
| INDOOR AIR | IA RESET | | | OFF {ON or OFF} | IA RESET OFF |
| | AVG TIME | | | 60 MIN {30 to 120 minutes} | AVG TIME 60MIN |
| | SET IAR SETPTS | DELTA TEMP @ HI IAR% | | 10°F {10 to 20°F}<br>70% {40 to 70%} | DELTA TEMP 10°F<br>@ HI IAR% 70% |
| | | DELTA TEMP @ LO IAR% | | 20°F {10 to 20°F}<br>40% {40 to 70%} | DELTA TEMP 20°F<br>@ LO IAR% 40% |
| | VIEW IAR VALUES | | | Display only, not changeable here — shows values for 8 zones | 70 70 70 70<br>70 70 70 70 |
| OUTDOOR AIR | OA SHUTDOWN | | | OFF {ON or OFF} | OA SHUTDOWN OFF |
| | OA SETPT | | | 68°F {40 to 100°F} | OA SETPT 68°F |
| | OA RESET | | | OFF {ON or OFF} | OA RESET OFF |
| | SET OA SETPTS | LOW WATER @ HI OA | | 140°F {60 to 150°F}<br>70°F {50 to 90°F} | LOW WATER 140°F<br>@ HI OA 70°F |
| | | HI WATER @ LOW OA | | 180°F {70 to 180°F}<br>10°F {-35 to +40°F} | HI WATER 180°F<br>@ LOW OA 10°F |
| PUMP OPTIONS | DELTA ENAB | | | OFF {ON or OFF} | DELTA ENAB OFF |
| | DELTA TEMP | | | 10°F {10 to 50°F} | DELTA TEMP 10°F |
| | PURGE TIME | | | 0 seconds {0 to 255 seconds} | PURGE TIME 120s |
| | ALWAYS ON | | | NO {YES or NO} | ALWAYS ON NO |
| | MASTER PUMP | | | OFF {ON or OFF} | MASTER PUMP OFF |
| NIGHT SETBACK | SETBACK # X | | | 1 {1 through 4} | SETBACK # 2 |
| | ENTRY IS OFF | SETBACK | | 20°F {0 to 50°F} | ENTRY IS OFF |
| | | ST DAY | | SUN {SUN, MON, TUE, WED, THU, FRI, SAT} | ST DAY THU |
| | | ST TIME | | 12:00AM | ST TIME 3:00PM |
| | | ENDDAY | | SUN {SUN, MON, TUE, WED, THU, FRI, SAT} | ENDAY SAT |
| | | ENDTIME | | 12:00AM | ENDTIME 10:00PM |
| OPTIONS | TEMP SCALE | | | °F {°F or °C} | TEMP SCALE °F |
| | KEY CLICK | | | ON {ON or OFF} | KEY CLICK ON |
| | SKIP PASSW | | | ON {ON or OFF} | SKIP PASSW ON |
| | BRIGHTNESS | | | 50% {12, 25, 37, 50, 62, 75, 87, 100%} | BRIGHTNESS 50% |

# 4 Control menus and adjustments *(continued)*

**Table 7** Setup menus (*see Table 8, page 25 for explanations*) *(continued)*

| | | | | | |
|---|---|---|---|---|---|
| LOG/RUNTIME | RUN HRS | | | Total time gas valve has been open | RUN HRS 1240 |
| | LOG ENTRY | | | Current entry in the log (see Table 9, page 30) | LOG ENTRY 327 |
| | SIZE | | | The size of the data log | SI<br>ZE 1000 |
| | BOILER CYC | | | Number of times gas valve has been cycled on/off | BOILER CYC 5021 |
| AUX FUNCTIONS | COMB AIR DAMPER IN USE? | | | YES {YES or NO} | COMB AIR DAMPER<br>IN USE? YES |
| | USE RELAY # | | | OPT | USE RELAY # OPT |
| | PROOF TIME | | | 2:00 (2 min, 0 sec) {0 to 4 minutes} | PROOF TIME 2:00 |
| | DHW PROTECTION IN USE? | | | NO {YES or NO} | DHW PROTECTION<br>IN USE? NO |
| SYSTEM CLOCK | TIME | | | 12:00AM | TIME 11:20AM |
| | DAY OF WEEK | | | SUN | DAY OF WEEK MON |
| | MONTH | | | SEP | MONTH JAN |
| | DAY | | | 12 | DAY FRI |
| | YEAR | | | 2007 | YEAR 2007 |
| ADVANCED SETUP | DISTRIB CTRL | CONTROL | | HNET | CONTROL HNET |
| | | HNET MASTER | | YES (Display only, not changeable here) | HNET MASTER YES |
| | | LOCAL ADD | | Master default = 255 (not changeable)<br>Member default = 2 (Range = 2 to 16) | LOCAL ADD 255 |
| | | CONSOLE ADD | | Default = 1; Range = 1 to 247 | CONSOLE ADD 255 |
| | MODULAR BOILER | ADD BOILER DLY | | 10 minutes {0 to 15 minutes} | 10 MINUTES<br>> 0 SECONDS |
| | | SHED BOILER DLY | | 2 minutes {0 to 15 minutes} | 2 MINUTES<br>> 0 SECONDS |
| | | MOD DELAY TIME | | 10 seconds {0 to 60 minutes} | 0 MINUTES<br>> 10 SECONDS |
| | | MOD MAX - LAST | | 50% {25 to 100%} | STOP MOD MAX<br>> % 50 |
| | | STOP BAND OFSET | | 5°F {0 to 50°F} | EARLY STOP<br>> 5° |
| | | BLR START TIME | | 50 seconds {0 to 4 minutes} | 0 MINUTES<br>> 30 SECONDS |
| | MODULATION PID | (P)ROPOR = | | 100 {0 to 100} | (P)ROPOR = 100 |
| | | (I)NTEGRAL= | | 10 {0 to 100} | (I)NTEGRAL = 10 |
| | | (D)ERIVAT = | | 10 {0 to 100} | (D)ERIVAT = 10 |
| | | BAND | | 100°F {40 to 18 0°F} | BAND 100°F |
| | FIRING MODE | ROTATION | | TRUE {True, FOFO, LOFO} | ROTATION TRUE |
| | | MASTER 1ST | | OFF | MASTER 1ST OFF |
| | SENSORS | SENSOR# | | OUTSIDE | SENSOR# SUPPLY |
| | | TYPE | | TYPEZ {TYPEZ, None, ON/OFF} | TYPE TYPEZ |
| | | CALIBRATE ? | | NO {YES or NO} | CALIBRATE ? NO |
| | PASSWORD | CHANGE PASSWORD OLD:>?_____ | | Press SELECT, enter old password using arrow keys and SELECT for each character | CHANGE PASSWORD<br>OLD:>?_ _ _ _ _ _ |
| | | CHANGE PASSWORD NEW:>?_____ | | Press SELECT, enter new password using arrow keys and SELECT for each character | CHANGE PASSWORD<br>NEW:>?_ _ _ _ _ _ |
| | | ACCEPT > | | YES / YES or NO | CHANGE PASSWORD<br>ACCEPT >YES |
| | COMMUNICATIONS | BAUD | | 19200 | BAUD 19200 |
| | | PARITY | | EVEN {EVEN or ODD} | PARITY EVEN |
| | | MODEM | | NO {YES or NO} | MODEM NO |
| | LOAD DEFAULTS | FACTORY CAL? | | NO {YES or NO} | FACTORY CAL? NO |
| | | | ARE YOU SURE> | NO {YES or NO} | ARE YOU SURE> NO |
| | | FACTORY SET? | | NO {YES or NO} | FACTORY SET? NO |
| | | | ARE YOU SURE> | NO {YES or NO} | ARE YOU SURE> NO |
| | SYSTEM | UPDATE CTRL? | ARE YOU SURE> | NO {YES or NO} | UPDATE CTRL? |



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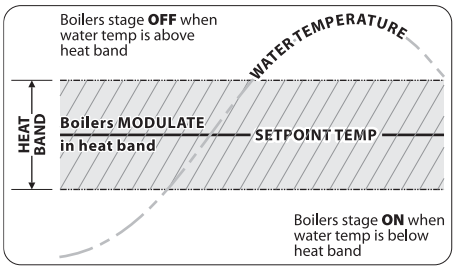
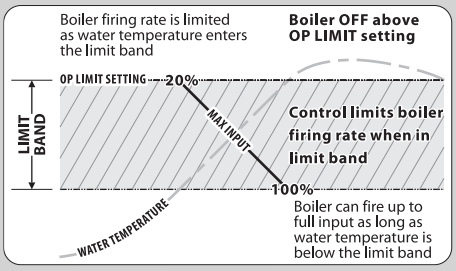
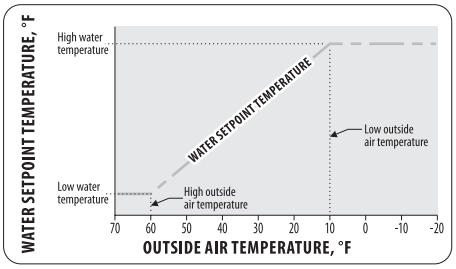
# 4 Control menus and adjustments *(continued)*

**Table 8** Setup menus — parameter explanations

| Menu item | Under . . . | Explanation |
|---|---|---|
| **HEAT BAND** | BOILERS |  The heat band is the height of the modulating band. When the water temperature is between ½ the heat band above or below the setpoint temperature, boiler firing rate modulates. Boilers are at minimum input at the upper end of the band and maximum input at the lower end of the band. Boilers come on only if the water temperature is below the band. Boilers stage off when the water temperature is above the band. |
| **LOC SETPT** | SETPOINTS | Setpoint temperature controlled by the KN control.<br>NOTE: If the control is operated by a Master control or by a remote control (building management system, 4-20ma control, etc.), this setpoint temperature only comes into play when the KN-2 control is in override mode (such as by closing its Heat Demand or DHW Demand terminals). |
| **SOURCE** | SETPOINTS | Specifies where the space heating setpoint temperature comes from:<br>AUTO means the KN control determines the setpoint (using local setpoint, outdoor reset or header temperature setpoint).<br>The option is "4-20ma." If 4-20 ma is selected, the KN control determines setpoint based on the signal it receives at the 4-20ma terminals on the connection board. The setpoint temperature (°F) equals the signal current (ma) divided by 0.09; example, a signal of 10ma will cause a setpoint of 10/0.09 = 110°F. |
| **DHW SETPT** | SETPOINTS | This is the setpoint temperature for the boiler outlet water (or header water temperature) when the DHW Demand terminals see a closed contact (DHW tank temperature control calls for heat, for example). |
| **OP LIMIT** | SETPOINTS | This is the temperature at the boiler outlet (or header sensor) that will cause the control to shut down on high temperature limit. It must be high enough above the upper end of the heat band to avoid nuisance cycling.<br>The maximum setting is 205°F.<br>Example: If the boiler setpoint is 180°F, and the heat band is 30°F, the upper end of the heat band is 180 + 30/2 = 195°F. The limit band (see below) must be set at 10°F so the OP LIMIT setting can be: 195 + 10 = 205°F (maximum allowable setting).<br>The operating limit setting (OP LIMIT) always limits boiler outlet water temperature, regardless of how the boiler is controlled (HeatNet member, 4-20ma control or stand-alone). The limit band (see below) determines when the boiler begins to be forced to reduce input as the outlet temperature rises toward the limit setting. |
| **LIMIT BAND** | SETPOINTS |  If the boiler outlet water temperature rises toward the limit setting (OP LIMIT, above), the KN control will begin to reduce the boiler's firing rate when the temperature gets within the LIMIT BAND degrees F below the operating limit setting. At the lower end of the limit band, the boiler can fire up to maximum input (100%). By the time the temperature reaches the upper end of the band (the OP LIMIT setting), the boiler is limited to minimum input (20%).<br>The limit band reduces the likelihood of short cycling on boilers controlled by a master control or a remote control by reducing boiler maximum allowable firing rate as the temperature rises toward the limit setting. Make sure the lower end of the limit band is above the upper end of the heat band. |

# 4 Control menus and adjustments *(continued)*

**Table 8** Setup menus — parameter explanations (continued)

| Menu item | Under . . . | Explanation |
|---|---|---|
| **IA RESET** | INDOOR AIR | Activate indoor air reset by setting this to "ON." Zone wiring must be made to the IAR input terminals for IAR to operate. See the Boiler manual for details on wiring to the IAR terminals. |
| **AVG TIME** | INDOOR AIR | The averaging time (AVG TIME) is the time span over which the control averages the results of zone demands. Leave this setting at the factory default unless directly otherwise by HydroTherm Technical Support. |
| **SET IAR SETPTS** | INDOOR AIR | Leave the delta temp settings at factory default settings unless directed otherwise by HydroTherm Technical Support. The determine how much the control adjusts maximum allowable firing rate based on its monitoring of zone demand. |
| **OA SHUTDOWN** | OUTDOOR AIR | When outdoor air shutdown is enabled (ON), the boiler and its circulating pump shut down when the outside temperature is above the outdoor air setpoint (OA SETPT). This requires an outdoor sensor when enabled. |
| **OA SETPT** | OUTDOOR AIR | The boiler and its circulator shut down when the outside air temperature is above this setting if outdoor air shutdown is enabled (ON). This requires an outdoor sensor when enabled. |
| **OA RESET** | OUTDOOR AIR | Set to "ON" to enable resetting the boiler outlet temperature (or header temperature) based on outside air temperature. Set to "OFF" to disable outdoor reset. This requires an outdoor sensor when enabled. |
| **LOW WATER @ HI OA**<br><br>**HI WATER @ LOW OA** | OUTDOOR AIR<br>SET OA SETPTS |  These temperatures determine the reset curve for supply water temperature. High water at low outside air means the design water temperature for maximum load (at ODT, or outside design temperature for the installation). The other end of the reset curve is the low water temperature at high outside air temperature. The low water temperature is generally equal to room temperature, meaning no heat input to the space would occur below this outside air temperature. |
| **DELTA ENABLE** | PUMP OPTIONS | The boiler pump can be set to run after boiler shutdown to distribute residual heat to the heating system. Delta enable causes the boiler pump to run until the temperature difference between boiler inlet and outlet is less than DELTA TEMP (see below). The pump will continue to run an additional period after this for the amount of time specified in PURGE TIME (below). |
| **DELTA TEMP** | PUMP OPTIONS | When DELTA ENABLE (above) is set to "ON," the boiler pump will run until the temperature difference across the boiler is less than DELTA TEMP. (The pump will run an additional time equal to the PURGE TIME.) An inlet temperature sensor is required. |
| **PURGE TIME** | PUMP OPTIONS | The boiler pump can run after boiler shutdown to distribute heat remaining in the boiler water. PURGE TIME sets how long the boiler pump will run. (Also see DELTA TEMP, above.) NOTICE: For systems that shut off flow valves (such as zone valve systems) when the call for heat is satisfied, this option must be set to "0" to prevent dead-heading the pump. |
| **ALWAYS ON** | PUMP OPTIONS | If ALWAYS ON is set to "YES," the boiler circulator never turns off. |
| **MASTER PUMP** | PUMP OPTIONS | If set to "ON," the master control in the network will keep its pump contacts closed (running its pump and/or control valve) if no other boilers are operating. This is used to prevent dead-heading system flow. |
| **SETBACK#** | NIGHT SETBACK | Setback number is the designator for the setback operation. Up to four (4) setback operations can be programmed. |



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# 4 Control menus and adjustments *(continued)*

**Table 8** Setup menus — parameter explanations (continued)

| Menu item | Under . . . | Explanation |
|---|---|---|
| **ENTRY IS** | NIGHT SETBACK | Select "ON" to enable a setback operation. Then program the times, days and setpoint. The setpoint assigned will override the KN control's setpoint when setpoint is controlled locally. It will not override 4-20ma control or building management control. |
| **TEMP SCALE** | OPTIONS | Select Fahrenheit or Centigrade. |
| **KEY CLICK** | OPTIONS | If activated, the control beeps when a key is pressed. |
| **SKIP PASSW** | OPTIONS | The control can be programmed such that a password is required to change settings. Setting this to "ON" disables the password. |
| **BRIGHTNESS** | OPTIONS | Adjust the brightness of the display. |
| **RUN HRS** | LOG/RUNTIME | Displays the total time the boiler gas valve has been open. |
| **LOG ENTRY** | LOG/RUNTIME | Displays the current entry in the data log (see Table 9, page 30). |
| **SIZE** | LOG/RUNTIME | Displays the current number of entries in the data log. |
| **BOILER CYC** | LOG/RUNTIME | Displays the number of times the boiler gas valve has been cycled on, then off. It does not include failed ignition attempts. |
| **COMB AIR DMPR IN USE?** | AUX FNCTIONS | Select "YES" to connect a combustion air damper and its end switch to the electrical connection board. |
| **USE RELAY #** | AUX FNCTIONS | Only one relay is available. |
| **PROOF TIME** | AUX FNCTIONS | Set proof time long enough to be sure the combustion air damper can open and activate its end switch. |
| **DHW PROTECTION** | AUX FUNCTIONS | Select "YES" to have the control alarm and disable the DHW demand input if a DHW demand lasts for more than 60 minutes. |
| **SYSTEM CLOCK** | | Set the system clock (time, day of week, month, day and year) on start-up and after any power outage to ensure the data log time stamp information will be accurate. |
| **LOCAL ADD** | ADVANCED SETUP DISTRIB CTRL | Assign each member boiler a unique address, beginning with "2" or higher. Enter any value from 2 to 16.<br>NOTE: When the master boiler control displays the number of boilers on the network, ***it will show numbers above 9 as letters***: 10=A; 11=B; 12=C; 13=D; 14=E, and 15=F. For example, if there are 12 boilers on the network, then the master control will show: "HeatNet BOILERS 123456789ABC" when displayed in the BOILERS menu.<br>The master boiler local address is automatically set to 255. (The master boiler is automatically recognized because it is the one with a header sensor wired to its HEADER SENSOR terminals.) |
| **CONSOLE ADD** | ADVANCED SETUP DISTRIB CTRL | This is used only when the boilers are regulated by a building management system, using MODBUS, BACNET or LONWORKS. Assign each member boiler AND the Heat Net master boiler a unique address, an value from 1 to 247. |
| **ADD BOILER DLY** | ADVANCED SETUP MODULAR BOILER | This is the minimum wait time before an additional boiler can fire when called on by the master boiler control. |
| **SHED BOILER DLY** | ADVANCED SETUP MODULAR BOILER | This is the minimum wait time before a boiler can shut down by the master boiler control. |

# 4 Control menus and adjustments *(continued)*

**Table 8** Setup menus — parameter explanations (continued)

| Menu item | Under . . . | Explanation |
|---|---|---|
| **MOD DELAY TIME** | ADVANCED SETUP MODULAR BOILER | The boiler will remain at minimum fire when first starting until this amount of time has elapsed. |
| **MOD MAX-LAST** | ADVANCED SETUP MODULAR BOILER | This sets the maximum firing percentage for boilers during times that some boilers are not firing. It limits input of the boilers to keep them as efficient as possible. Once all boilers are started (during high heat demand periods), this limit is remove, and all boilers can fire up to maximum input. Once any boiler is dropped offline, the limit is applied again. |
| **STOP BAND OFSET** | ADVANCED SETUP MODULAR BOILER | This setting helps reduce short-cycling when water temperature is within the heat band. If the water temperature rises to the top of the heat band less the STOP BAND OFFSET before a boiler just added has completed its modulation delay time, the boiler will shut down. Example, if the top of the heat band is 190°F and stop band offset is 15°F, a newly-added boiler will shut down if the temperature reaches 175°F (190 - 15) before its modulation delay time has ended. |
| **BLR START TIME** | ADVANCED SETUP MODULAR BOILER | DO NOT CHANGE — This is the time from receiving a call for heat to when a boiler begins its modulation operation (running at minimum fire). |
| **(P)ROPOR =** | ADVANCED SETUP MODULATION PID | This parameter should generally be left at factory default. |
| **(I)NTEGRAL =** | ADVANCED SETUP MODULATION PID | This parameter should generally be left at factory default. |
| **(D)ERIVAT =** | ADVANCED SETUP MODULATION PID | This parameter should generally be left at factory default. |
| **BAND** | ADVANCED SETUP MODULATION PID | This parameter should generally be left at factory default. |
| **ROTATION** | ADVANCED SETUP FIRING MODE | Select the rotation method. True rotation attempts to fire all boilers an equal amount of time. First on/first off jogs between boilers to balance usage. Last on/first off maintains the same rotation sequence at all times. |
| **MASTER 1ST** | ADVANCED SETUP FIRING MODE | Set this to "ON" to always start the master boiler first, regardless of the rotation scheme selected. |
| **SENSOR#** | ADVANCED SETUP SENSORS | There are up to three sensors: OUTSIDE, HEADER and RETURN. |
| **TYPE** | ADVANCED SETUP SENSORS | Type Z is for a thermistors sensor (as supplied by HydroTherm).<br>"None" means do not use this sensor.<br>ON/OFF looks for an external dry contact closure. |
| **CALIBRATE ?** | ADVANCED SETUP SENSORS | Use this function only if the response to a sensor indicates the control calibration may be off.<br>Calibrate the control by attaching a 10k precision resistor across the sensor terminals.<br>Select "YES" after "CALIBRATE ?."<br>The control will measure the resistance and establish a trim value (in ohms) for the sensor input.<br>The control display will show the trim value setting.<br>The trim value must not exceed +/- 200 ohms. If it does, verify that the resistor is correctly connected. If so, the sensor input is bad. Contact HydroTherm for recommended action.<br>If the trim setting is acceptable, press the SELECT key to accept.<br>The display will show, "TRIM VALUE SET!"<br>After a slight delay, the display will return to the sensors menu. |



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# 4 Control menus and adjustments *(continued)*

**Table 8** Setup menus — parameter explanations (continued)

| Menu item | Under . . . | Explanation |
|---|---|---|
| **CHANGE PASSWORD** | ADVANCED SETUP PASSWORD | Use to set/change a password. |
| **BAUD** | ADVANCED SETUP COMMUNICATIONS | Not changeable. Always 19200. |
| **PARITY** | ADVANCED SETUP COMMUNICATIONS | Select even or odd as required by communications port used. |
| **MODEM** | ADVANCED SETUP COMMUNICATIONS | Select "YES" only if a modem is installed. |
| **LOAD DEFAULTS** | ADVANCED SETUP | Load the factory defaults when you want to be sure nothing has been changed or after you have loaded new firmware.<br>1. Disconnect wires to the Heat Demand terminals and any other remote operation wiring. There must be no call for heat during the process.<br>2. Navigate the control display to "LOAD DEFAULTS.'<br>3. To restore factory calibration settings or factory settings, section either of the options and select "YES" for the prompt, "ARE YOUR SURE?" |
| **FIRMWARE VERSION (UPDATE CONTROL?)** | ADVANCED SETUP SYSTEM | The firmware version in the control must match the version in this manual in order to ensure accuracy of the installation/operation information. The control displays the firmware version number when Setup is accessed. To update the control's firmware, obtain a disk from HydroTherm.<br>1. Disconnect wires to the Heat Demand terminals and any other remote operation wiring. There must be no call for heat during the process.<br>2. Record all setup information for the application before proceeding.<br>3. Insert the Firmware Update Program disk into the computer. The program will start and show an option screen.<br>4. Select "Install USB Drivers" to install the program onto the computer.<br>5. After the USB driver installation is complete, select "Install Firmware Update."<br>6. Plug a USB cable into the control connection board, with the other connected to the computer. THE CABLE MUST BE CONNECTED BEFORE STARTING THE FIRMWARE UPDATE PROGRAM.<br>7. Start the Firmware Update Program. It will auto detect the KN-2 control. The program dialog box will automatically show the control's comport number in the first box.<br>8. The second box will show the firmware file number. Make sure this is the correct file. If not, use the ". . ." box to the right of the file name to navigate to the correct file.<br>9. Navigate to the control Advanced menu, "System."<br>10. Select "YES" to update the control.<br>11. NOTICE: The firmware must be downloaded now for the KN-2 control to function again.<br>12. Return to the computer. Select "UPDATE." The computer program will ask to turn the boiler off, then back on.<br>13. After the power is cycled on the boiler, the download will start.<br>14. If the download is interrupted or fails, turn the boiler ON/OFF switch OFF, then ON. Restart the firmware download program to start the download. (The boiler will appear unresponsive during this time because it is wating for the download to take place.)<br>15. When the download is complete, the boiler will power cycle. The display should show STANDBY.<br>16. If the firmware does not load correctly, the display will remain blank. Try running the firmware program again.<br>17. Check that the boiler performs properly. |

# 5 Troubleshooting

**Table 9** Accessing and using the Log

Enter Setup: From STANDBY, hold BACK for 5 seconds. Then press ▼ until the cursor points to VIEW LOG.

Press SELECT with the cursor on VIEW LOG.

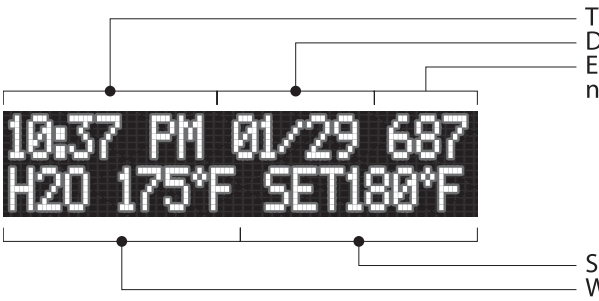
The screen will now show the most recent entry in the log.

Use the arrow keys to scroll through the log entries (entry number and date are on the first line of the log screen).

Each log entry includes three screens as described below. The top line remains the same in all three, and contains the date stamp and entry number.

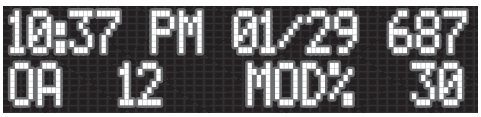
An entry is made each time a change in demand occurs, or when demand changes from heating to DHW or back, each prepurge and postpurge occurrence, and each ignition sequence. An entry is also made when any of the Screen 3 events (below) occurs. These events may be errors, faults or notification of setback activity.

## Screen 1 — Date stamp




Time of day
Date
Entry number (from 1 to 1000, highest number is most recent entry)
Setpoint temperature
Water temperature at time of entry

## Screen 2 — Outside temp and mod percentage




Shows the modulation percentage (from 20 to 100%). Mod readings can often be an indicator of boiler status. Examples: 45% may indicate prepurge, while 30% may indicate the boiler was in ignition sequence.

Outside air temperature, if sensor connected; otherwise, display = NA

## Screen 3 — Status or messages (see right)

Displays "HD" for heat demand, "DH" for DHW demand, "NC" is there is no call for heat, or "LK" if boiler is called to heat by the master boiler

Display will show "P" if boiler pump was on; "M" if main valve was open; "D" if combustion air damper was energized; "B" if blower was on; and"I" if ignition cycle was in process

"B" indicates bypass pump was on; 100 or other value shows the IAR MAX INPUT value if there was a heat demand at the time

**NOTICE**: The second line will show typical reading as shown unless an error code is displayed. See codes at right.

## Screen 3 — Messages:

- **NO FLOW SENSED**
- **OPERATE HIGH LIMIT** (high limit tripped)
- **SETPT LIMIT** (OP LIMIT reached)
- **SETBACK #__ IS ACT** (setback initiated, shows 1 to 4)
- **SETBACK #__ EXPIRED** (setback completed, shows 1 to 4)
- **COMBUST AIR FAIL**
- **SYST RESET OURWP** (internal control processor error detection)
- **OUTDOOR RESET**
- **OPEN**, with **SUPPLY**, **HEADER**, **OA** or **RETURN** (sensor is open)
- **SHORT**, with **SUPPLY**, **HEADER**, **OA** or **RETURN** (sensor is shorted)
- **FOUND BOILER #** (master boiler detecting member boiler)
- **LOST BOILER #** (master boiler losing signal from member boiler)
- **IGN LOCKOUT**
- **USER INTERLOCK**
- **BLOCKED FLUE**
- **BLOCKED INLET**
- **IAR COMM FAILURE** (indicates problem with wiring between control and connection board)
- **IGN LOCKOUT RETRY**
- **BLOWER PROVE FAULT** (blower did not prove during pre-purge time)



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# 5 Troubleshooting *(continued)*

| Situtation | Suggested procedure |
|---|---|
| Nothing happens when the power switch is turned on. | ❑ Check 120VAC power to connection board. Verify power is connected per wiring diagrams.<br>❑ The Power switch light (ON -Position) should illuminate if power is wired correctly.<br>❑ If the Ignition Control is active, but the front panel display is inactive check:<br>1. Cable and cable polarity from the control board to the display.<br>2. Check for 120vac on the primary of the transformer and 24vac on the secondary. If one of the 24vac interlocks has been shorted to ground or the 24vac output is low, the transformer may be damaged or a 24vac circuit may be miswired.<br>❑ The KN control is equipped with resettable fuses on the power input circuit. Wiring power incorrectly to the unit will cause these fuses to open. Once the incorrect wiring is corrected, the fuses should reset themselves in less than 5 minutes. |
| The display shows combustion air damper failure. | ❑ If you are not using the combustion air damper then it needs to be disabled in the AUX FUNCTIONS menu.<br>❑ The prove switch for the combustion air damper is not closing. Check to make sure the dampers are being controlled by the output relay you specified when programming for the damper. Also check to make sure the prove switch is working properly.<br>❑ If there is no proving switch, you must put a jumper wire across input connection (USER INTRLK).<br>❑ If these steps have been done and you continue to get the error message, check the sensor TYPE specified in the SENSORS menu. If it is set to NONE, the controller will not recognize the closed circuit. Set the Sensor type to ON/OFF. |
| The display is displaying random characters or the control keeps resetting. | ❑ There may exist a grounding problem with the controller or one of the boilers, pumps, contactors or other devices connected to it.<br>❑ If all grounding is correct, there may be an issue with radiated or induced electrical noise (interference). This may be caused by arcing across a contactor's contacts when starting a pump motor or a large electrical load. It may also be caused by the ignition transformer being improperly grounded or the spark gap being out of adjustment.<br>❑ Attempt to identify the noise source:<br>1. What is the boiler/controller trying to do at the time of the failure?<br>2. Is the boiler on the same circuit as the noise source? (The boiler should have isolated power.)<br>3. Are shielded sensor wires used? (Ensure the shields are grounded only at the boiler control end.)<br>4. Are any sensors or sensor wires located near a transmitting antenna? (Move sensor) |
| There are no heating boilers on. | ❑ Check the settings for OA SETPOINT and OA RESET.<br>1. If the outdoor air temperature is above the OA SETPOINT and OA RESET is on, the circulator pump relay will be locked out and the heating boilers will not fire.<br>2. If the water temperature is within the heating band around the setpoint, boilers will not come on.<br>3. The water temperature must fall below the lower band limit to begin firing boilers. |
| Unable to change the # of Boilers in the BOILERS menu. | ❑ In H-Net method, the KN control auto-detects the boilers in the system and adjusts the number of boilers accordingly.<br>❑ Using H-NET, if the numbere of boilers is not being detected properly as the actual number of boilers in the system, check each boiler. There can only be (1) master boiler, but there can be up to 15 member boilers.<br>❑ Make sure only the master boiler has a Header Sensor connected.<br>❑ Verify that each boiler's HeatNet cable is in place.<br>❑ Verify that each boiler has a unique address assigned (ADVANCED SETUP, DISTRIB CTRL, LOCAL AD). |
| The BOILERS menu only indicates one boiler, but there are member boilers connected. The amber light blinks on all of the boilers communication's jacks. | ❑ Verify that the latest version of firmware is installed on all boilers.<br>❑ All boilers in a system must have the same firmware revision (version).<br>❑ Verify the proper termination is set on the Master and the last Member boiler. |

# 5 Troubleshooting *(continued)*

| Situtation | Suggested procedure |
|---|---|
| HeatNet boilers are detected but then lost and then detected again. | ❑ The H-Net communications cable may be receiving interference from the blower, ignition, or other form of radiated electrical noise.<br>❑ Termination of the jumpers may not be correct or there is more than one master.<br>1. Ensure that the termination dip switchs are set on the MASTER boiler and only the LAST MEMBER boiler. All of the other member boilers should have their termination dip switches OFF.<br>2. There may be two or more MASTER boilers. Ensure that only one header sensor is present and connected to the HEADER input. There should be no wires or sensors connected to the HEADER input if the boiler is operating as a member.<br>3. Verify that the HNet cables are of a shielded or twisted pair type. Shielding of the cable is required.<br>4. Minimize possible electrical interference by routing the communications cables away from electrical noise sources, such as motors, ignition controls, contactors, etc. |
| Only the MASTER boiler Fires, but the system has many boilers and is using HeatNet. | ❑ In order for the MASTER boiler to act as a MASTER, the header sensor must be set to TYPEZ, and there must be a header sensor present.<br>❑ At power-up, the header sensor is auto detected. If the temperature of the header sensor at power-up is greater than –25 °F and less than 240 °F it is considered a valid sensor. The boiler will default to the MEMBER mode if the temperature is not in this range, and can only be run locally or by external inputs.<br>❑ The HNet needs a communications cable daisy-chained between boilers. Ensure that a good connection is made on the communications board and that the lights on the dual RJ45 jacks flash (roughly twice a second). The MASTER is the only one that should flash with no communications cables plugged in. |
| You get the error message – WATER FLOW SWITCH or WAITING FOR FLOW. | ❑ If the control does not sense a closed circuit at input connection, FLOW SWITCH, check to make sure the circuit for the circulator pump is correct, that the pump is being energized, and that the flow prove switch is working properly.<br>❑ If there is no flow prove switch, check to make sure that a jumper wire has been connected across the FLOW SWITCH terminals. |
| You have forgotten the password. | ❑ Turn the ON/OFF switch off. Then depress and hold the ESC key while turning it back on. This will load the default password "AAAAAA". |
| Firmware update program starts to load, but then stops. | ❑ Ensure that the USB driver for your PC/Laptop computer is properly installed. |

HydroTherm®

A MESTEK COMPANY

IN UNITED STATES: 260 NORTH ELM ST. • WESTFIELD, MA 01085 • (413) 564-5515 • FAX (413) 568-9613
IN CANADA: 7555 TRANMERE DRIVE • MISSISSAUGA, ONT. L5S 1L4 • (905) 672-2991 • FAX (905) 672-2883
www.hydrothermkn.com



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